CHRIST (Deemed to University), Bangalore

DEPARTMENT OF MECHANICAL AND AUTOMOBILE ENGINEERING

SCHOOL OF ENGINEERING AND TECHNOLOGY

Syllabus for
Bachelor of Technology (Mechanical Engineering)
Academic Year (2023)

3 Semester - 2022 - Batch					
Course Code	Course	Type	Hours Per Week	Credits	Marks
BS351	ENGINEERING BIOLOGY LABORATORY	Core Courses	2	2	50
EVS321	ENVIRONMENTAL SCIENCE	Skill Enhancement Courses	2	0	0
MA331	MATHEMATICS - III	Core Courses	3	3	100
MAHO331DMP	DESIGN FOR ADDITIVE MANUFACTURING	Minors and Honours	4	4	100
ME332	BASIC THERMODYNAMICS	Core Courses	3	3	100
ME333P	STRENGTH OF MATERIALS	Core Courses	5	4	100
ME334P	MANUFACTURING PROCESSES	Core Courses	5	4	100
ME335P	INSTRUMENTATION AND CONTROL	Core Courses	5	4	100
4 Semester - 2022 - Batch					
Course Code	Course	Type	Hours Per Week	Credits	Marks
CY421	CYBER SECURITY	-	2	0	0
HS421	PROFESSIONAL ETHICS	-	2	2	50
MAHO431DMP	COMPUTER AIDED ENGINEERING	-	4	4	100
ME431	APPLIED THERMODYNAMICS	-	3	3	100
ME432P	MATERIAL ENGINEERING	-	5	4	100
ME433P	FLUID MECHANICS AND FLUID MACHINES	-	5	4	100
ME434	ENTREPRENEURSHIP DEVELOPMENT	-	2	2	50
ME436	COMPUTER AIDED MACHINE DRAWING	-	4	3	100
ME451	RENEWABLE ENEGRY LAB	-	2	1	50
MICSAI432	DATA STRUCTURES AND ALGORITHMS	-	5	4	100
5 Semester - 2021 - Batch					
Course Code	Course	Type	Hours Per Week	Credits	Marks
CEOE531	SOLID WASTE MANAGEMENT	Interdisciplinary Elective Courses	3	3	100
CEOE532	DISASTER MANAGEMENT	Interdisciplinary Elective Courses	3	3	100
CH536OE1	ELECTRONIC MATERIALS AND ITS FABRICATION	Interdisciplinary Elective Courses	3	3	50
HS522	PROJECT MANAGEMENT AND FINANCE	Core Courses	2	2	50
IC521	INDIAN CONSTITUTION	Skill Enhancement Courses	2	0	50
MA536OE6	APPLIED STATISTICS	Interdisciplinary Elective Courses	3	2	50
ME531	KINEMATICS AND THEORY OF MACHINES	Core Courses	3	3	100
ME532	DESIGN OF MACHINE ELEMENTS	Core Courses	3	3	100
ME533P	INTERNAL COMBUSTION ENGINES	Core Courses	4	3	100
ME544E2	NON-CONVENTIONAL ENERGY RESOURCES	Discipline Specific Elective Courses	3	3	100
ME551	ANALYSIS LABORATORY	Core Courses	2	1	50

ME552	AUTOMATION LABORATORY	Core Courses	2	1	50
NCCOE1	NCC1	Interdisciplinary Elective Courses	3	3	100
VMEC511	FUNDAMENTALS OF CAE SIMULATIONS	-	4	0	50

6 Semester - 2021 - Batch

Course Code	Course	Type	Hours Per Week	Credits	Marks
BTGE631	CORPORATE SOCIAL RESPONSIBILITY	-	2	2	100
BTGE632	DIGITAL MEDIA	-	2	2	100
BTGE633	FUNCTIONAL ENGLISH	-	2	2	100
BTGE634	GERMAN	-	2	2	100
BTGE635	INTELLECTUAL PROPERTY RIGHTS	-	2	2	100
BTGE636	INTRODUCTION TO AVIATION	-	2	2	100
BTGE637	PROFESSIONAL PSYCHOLOGY	-	2	2	100
BTGE651	DATA ANALYTICS THROUGH SPSS	-	2	2	100
BTGE652	DIGITAL MARKETING	-	2	2	100
BTGE653	DIGITAL WRITING	-	2	2	100
BTGE654	PHOTOGRAPHY	-	2	2	100
BTGE655	ACTING COURSE	-	2	2	100
BTGE656	CREATIVITY AND INNOVATION	-	2	2	100
BTGE657	PAINTING AND SKETCHING	-	2	2	100
BTGE658	DESIGN THINKING	-	2	2	100
ME631	DESIGN OF TRANSMISSION SYSTEM	-	3	3	100
ME632P	HEAT TRANSFER	-	5	4	100
ME633P	AUTOMATION IN MANUFACTURING	-	5	4	100
ME637	SERVICE LEARNING	-	2	2	50
ME644E11	BASIC AEROSPACE ENGINEERING	-	3	3	100
ME644E4	SUPPLY CHAIN MANAGEMENT	-	3	3	100
ME651	COMPUTER AIDED ENGINEERING LABORATORY	-	2	1	50

7 Semester - 2020 - Batch

Course Code	Course	Type	Hours Per Week	Credits	Marks
CSOE763E04	BASICS OF MOBILE APPLICATION DEVELOPMENT	Interdisciplinary Elective Courses	3	3	100
ECOE7601	AUTOMOTIVE ELECTRONICS	Interdisciplinary Elective Courses	3	3	100
EEOE731	BATTERY MANAGEMENT SYSTEMS FOR ELECTRICAL VEHICLES	Interdisciplinary Elective Courses	3	3	100
ME733P	VIBRATIONS AND CONTROL	Core Courses	5	4	100
ME741E1	FLEXIBLE MANUFACTURING SYSTEM	Discipline Specific Elective Courses	3	3	100
ME741E6	ADVANCED AUTOMOTIVE ENGINEERING	Discipline Specific Elective Courses	3	3	100
ME742E1	OPERATIONS MANAGEMENT	Discipline Specific Elective Courses	3	3	100
ME742E8	MACHINE LEARNING USING PYTHON PROGRAMMING	Discipline Specific Elective Courses	3	3	100
ME744E4	RAPID PROTOTYPING	Discipline Specific Elective Courses	3	3	100
ME744E7	LEAN MANUFACTURING	Discipline Specific Elective Courses	3	3	100
ME751	SIMULATION LABORATORY	Core Courses	2	1	50
ME781	PROJECT WORK PHASE I	Project	4	2	100
ME782	INTERNSHIP	Core Courses	4	2	50
NCCOE2	NCC2	Interdisciplinary Elective Courses	3	3	100

8 Semester - 2020 - Batch

Course Code	Course	Type	Hours Per Week	Credits	Marks
ME841E5	GREEN BELT PRACTICE	-	3	3	100
ME841E7	AGILE MANUFACTURING	-	3	3	100
ME881	PROJECT WORK PHASE II	-	20	10	300

Introduction to Program:

The mechanical engineering department is equipped to meet the present day technological advances and to meet the industrial requirements matching with the global standards. The four year course in mechanical Engineering is designed to give the student the necessary training in access and use of most recent technologies.

The department has state of the art laboratories through which practical knowledge necessary for the present day industrial applications is provided.Workshops with latest equipment, computer-aided engineering are provided to help students access latest developments in the field.

Programme Outcome/Programme Learning Goals/Programme Learning Outcome:

PO1: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

Programme Specific Outcome:

PO2: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

Programme Educational Objective:

PO3: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one?s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Assesment Pattern

COURSES WITH THOERY AND PRACTICAL										
THEORY						PRACTICAL				
	Component	Assessed for	Scaled down to	Min. marks to pass	Max. marks	Component	Assessed for	Scaled down to	Min. marks	Max. marks
1	CIA-1	20	**10**	-	**10**	Overall CIA	**50**	**35**	**14**	**35**
2	CIA-2	50	**10**	-	**10**					
3	CIA-3	20	**10**	-	**10**					
4	Attendance	05	**05**	-	**05**	Attendance	**NA**	**NA**	**-**	**-**
5	ESE	100	**30**	12	**30**	ESE	**NA**	**NA**	**-**	**-**
		TOTAL	**65**	-	**65**	TOTAL		**35**	**14**	**35**

THEORY					
	Component	Assessed for	Scaled down to	Min. marks to pass	Max. marks
1	CIA-1	20	**10**	-	**10**
2	CIA-2	50	**25**	-	**25**
3	CIA-3	20	**10**	-	**10**
4	Attendance	05	**05**	-	**05**
5	ESE	100	**50**	20	**50**
		TOTAL	**100**	-	**100**

Practical Alone

Sl No	Component	Assessed for	Scale down to
1	CIA	50	25
2	ESE	50	25
3	Total	100	25

Examination And Assesments

	Category	Weightage for CIA	Weightage for ESE
1	Courses with theory and practical	70	30
2	Courses with only theory	50	50
3	Courses with only Practical	50	50

BS351 - ENGINEERING BIOLOGY LABORATORY (2022 Batch)

Total Teaching Hours for Semester:30 **No of Lecture Hours/Week:2**

Max Marks:50 **Credits:2**

Course Objectives/Course Description

Understanding and application of MATLAB and TINKERCAD for biological analysis which would results in better healthcare and any engineer, irrespective of the parent discipline (mechanical, electrical, civil, computer, electronics, etc.,) can use the disciplinary skills toward designing/improving biological systems. This course is designed to convey the essentials of human physiology.

The course will introduce to the students the various fundamental concepts in MATLAB and TINKERCAD for numerical analysis and circuit design using arduino.

Course Outcome

CO1Perform basic mathematical operation and analysis on biological parameters as BMI, ECG using MATLAB.L4

CO2Perform basic image processing on RGB images pertaining to medical data using MATLABL4

CO3Perform analysis on biological parameters using TinkerCad and design mini projects applicable for healthcare and biosensing.L4

Unit-1 **Teaching Hours:30**

LIST OF EXPERIMENTS

1. To familiarize with Matlab Online and getting used to basic functionalities used in Matlab (arrays, matrices, tables, functions)
2. To calculate the Body Mass Index (BMI) of a person and determine under what category the person falls under – underweight, normal, overweight
3. To determine the R peaks in given ECG and to find HRV using Matlab.

4. To determine the R peaks in given ECG and to find HRV using Matlab.
5. To determine the R peaks in given ECG and to find HRV using Matlab.
6. Introduction to Tinkercad and using the various tools available for running a simple program of lighting a LED bulb using Arduino (digital).
7. To design a driver motor in Tinkercad using Arduino and driver motor
8. To design a temperature sensor in Tinkercad using Arduino and TMP36
9. To design and simulate gas sensors using potentiometers, Arduino and servo motors
10. To design and simulate measuring pulse sensors using photodiodes, IR LED and Arduino
11. Preparation of biopolymers (polylactic acid) at home using home-based ingredients.

Text Books And Reference Books:

Essential Reading / Recommended Reading

Evaluation Pattern

As per university norms

EVS321 - ENVIRONMENTAL SCIENCE (2022 Batch)

Total Teaching Hours for Semester:30 **No of Lecture Hours/Week:2**

Max Marks:0 **Credits:0**

Course Objectives/Course Description

To understand the scope and importance of environmental science towards developing a conscious community for environmental issues, both at global and local scale.

Course Outcome

CO1: Explain the components and concept of various ecosystems in the environment (L2, PO7)

CO2: Explain the necessity of natural resources management (L2, PO1, PO2 and PO7)

CO3: Relate the causes and impacts of environmental pollution (L4, PO1, PO2, and PO3, PO4)

CO4: Relate climate change/global atmospheric changes and adaptation (L4,PO7)

CO5: Appraise the role of technology and institutional mechanisms for environmental protection (L5, PO8)

Unit-1 **Teaching Hours:6**

Introduction

Environment and Eco systems – Definition, Scope and importance. Components of environment. Concept and Structure of eco systems. Material Cycles – Nitrogen, Carbon, Sulphur, Phosphorous, Oxygen. Energy Flow and classification of Eco systems.

Unit-2 **Teaching Hours:6**

Natural Resources

Classification and importance- Forest, Water, Mineral, Food, Energy. Management of natural resources – challenges and methods. Sustainable development – Goals, Agriculture, Industries

Unit-3 **Teaching Hours:6**

Environmental Pollution

Causes and Impacts – Air pollution, Water pollution, Soil Pollution, Noise Pollution, Marine Pollution, Municipal Solid Wastes, Bio Medical and E-Waste. Solid Waste Management

Unit-4 **Teaching Hours:6**

Climate change/Global Atmospheric Change

Global Temperature, Greenhouse effect, global energy balance, Global warming potential, International Panel for Climate Change (IPCC) Emission scenarios, Oceans and climate change. Adaptation methods. Green Climate fund. Climate change related planning- small islands and coastal region. Impact on women, children, youths and marginalized communities

Unit-5 **Teaching Hours:6**

Environmental Protection

Technology, Modern Tools – GIS and Remote Sensing,. Institutional Mechanisms - Environmental Acts and Regulations, Role of government, Legal aspects. Role of Nongovernmental Organizations (NGOs) , Environmental Education and Entrepreneurship

Text Books And Reference Books:

T1Kaushik A and Kaushik. C. P, "Perspectives in Environmental Studies"New Age International Publishers, New Delhi, 2018 [Unit: I, II, III and IV]

T2Asthana and Asthana, "A text Book of Environmental Studies", S. Chand, New Delhi, Revised Edition, 2010 [Unit: I, II, III and V]

T3Nandini. N, Sunitha. N and Tandon. S, "environmental Studies" , Sapana, Bangalore, June 2019 [Unit: I, II, III and IV]

T4R Rajagopalan, "Environmental Studies – From Crisis to Cure", Oxford, Seventh University Press, 2017, [Unit: I, II, III and IV]

Essential Reading / Recommended Reading

R1.Miller. G. T and Spoolman. S. E, "Environmental Science", CENAGE Learning, New Delhi, 2015

R2.Masters, G andEla, W.P (2015), Introduction to environmental Engineering and Science, 3rd Edition. Pearson., New Delhi, 2013.

R3.Raman Sivakumar, "Principals of Environmental Science and Engineering", Second Edition, Cengage learning Singapore, 2005.

R4.P. Meenakshi, "Elements of Environmental Science and Engineering", Prentice Hall of India Private Limited, New Delhi, 2006.

R5.S.M. Prakash, "Environmental Studies", Elite Publishers Mangalore, 2007

R6.ErachBharucha, "Textbook of Environmental Studies", for UGC, University press, 2005.

R7. Dr. Pratiba Sing, Dr. AnoopSingh and Dr. PiyushMalaviya, "Textbook of Environmental and Ecology", Acme Learning Pvt. Ltd. New Delhi.

Evaluation Pattern

No Evaluation

MA331 - MATHEMATICS - III (2022 Batch)

Total Teaching Hours for Semester:45 **No of Lecture Hours/Week:3**

Max Marks:100 **Credits:3**

Course Objectives/Course Description

Course Description :

This course, Mathematics III (MA331) is offered for three credits in the third semester for the branch of Mechanical, Automobile and Civil engineering. The concepts of Fourier series and Calculus of Variations, analytical methods of solving Partial Differential equations and Series solution of Ordinary Differential Equations along with Numerical methods to solve Algebraic as well Differential equations, various interpolation techniques are discussed in this course.

Course Objectives :

To enable the students to find the Fourier series and harmonic analysis of a periodic function, solve the boundary value problems using Fourier series, ordinary differential equations by series solution method and describe functionals and solve variational problems.

Course Outcome

CO-1: Develop the trigonometric series as Fourier expansion. {L4 } {PO1, PO2, PO3, PO4}

CO-2: Classify the nature of partial differential equations and hence solve it by different methods. {L3} {PO1, PO2, PO3}

CO-3: Solve boundary value problems using Fourier series {L3} {PO1, PO2, PO3}

CO-4: Solve ordinary differential equation using series solution method {L3} {PO1, PO2, PO3}

CO-5: Apply Euler?s equation to solve the optimal values of the functional. {L3} {PO1, PO2, PO3}

Unit-1 **Teaching Hours:8**

FOURIER SERIES

Periodic functions, Dirichlet's conditions, General Fourier series, Odd and even functions, Half range sine and cosine series, Harmonic Analysis.

Unit-2 **Teaching Hours:10**

PARTIAL DIFFERENTIAL EQUATIONS

Formation of PDE, Solution of homogeneous PDE involving derivative with respect to one independent variable only (Both types with given set of conditions), solution of non- homogeneous PDE by direct integration, Solution of Lagrange's linear PDE of the type $P\,p + Q\,q = R$

Unit-3 **Teaching Hours:9**

BOUNDARY VALUE PROBLEMS

Various possible solutions of one-dimensional wave and heat equations, two-dimensional Laplace's equation by the method of separation of variables. Solution of all these equations with specified boundary conditions.

Unit-4 **Teaching Hours:8**

SERIES SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS

Power Series solutions of differential equations, ordinary point, singular point, Frobenius method

Unit-5 **Teaching Hours:10**

CALCULUS OF VARIATIONS

Variation of a function, Variational problems, Euler's equation and its solution, Standard variation problems including geodesics, minimal surface of revolution, hanging chain and Brachistochrone problems. Functional; functionals involving higher order derivatives.

Text Books And Reference Books:

T1. Dr. B. Grewal, "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, July 2014.

T2. H. K. Das & Rajnish Verma, "Higher Engineering Mathematics", 20th Edition, S. Chand & Company Ltd., 2012

Essential Reading / Recommended Reading

R1. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, John Wiley & Sons,Inc. 2011.

R2. B.V. Ramana, 6th Reprint, "Higher Engineering Mathematics", Tata-Macgraw Hill, 2008

R3. George F. Simmons and Steven G. Krantz, "Differential Equation, Theory, Technique and Practice", Tata McGraw – Hill, 2006.

R4. M. D. Raisinghania, "Ordinary and Partial Differential Equation", Chand (S.) & Co. Ltd., India, March 17, 2005

Evaluation Pattern

CIA-1	**10**
CIA-2	**25**
CIA-3	**10**
Attendance	**05**
ESE	**50**

MAHO331DMP - DESIGN FOR ADDITIVE MANUFACTURING (2022 Batch)

Total Teaching Hours for Semester:75 **No of Lecture Hours/Week:4**

Max Marks:100 **Credits:4**

Course Objectives/Course Description

Additive Manufacturing (AM) is an economically viable alternative to conventional manufacturing technologies for producing highly complex parts. The main objective of this course is to acquaint students with the concept of AM, various AM technologies, selection of materials for AM, modeling of AM processes, and their applications in various fields. The course will also cover AM process plan including building strategies and post-processing.

Course Outcome

CO1: Demonstrate the knowledge of Additive Manufacturing and Rapid Prototyping technologies. {L2}

CO2: Describe different RP techniques used by manufacturing industries. {L2}

CO3: Discuss the fundamentals of various mechanisms used in modern machine tools to accommodate additive manufacturing. {L2}

CO4: Analyze various reverse engineering techniques in preparing STL models and 3D- CAD models to incorporate in rapid prototyping techniques. { L3}

CO5: Examine various techniques in additive manufacturing techniques for preparing a better product. {L2}

Unit-1

Introduction

Overview, Basic principle need and advantages of additive manufacturing, Procedure of product development in additive manufacturing, Classification of additiv Materials used in additive manufacturing, Challenges in Additive Manufacturing.

Unit-2

Additive manufacturing Techniques

Z-Corporation 3D-printing, Stereolithography apparatus (SLA), Fused deposition modeling (FDM), Laminated Object Manufacturing (LOM), Selecti (SDL), Ultrasonic consolidation, Selective laser sintering (SLS), Laser engineered net shaping (LENS), Electron beam free form fabrication (EBFFF), Elect Plasma transferred arc additive manufacturing (PTAAM), Tungsten inert gas additive manufacturing (TIGAM), Metal inert gas additive manufacturing (

Unit-3

CNC Technology

Axes, Linear motion guide ways, Ball screws, Motors, Bearings, Encoders/ Glass scales, Process Chamber, Safety interlocks, Sensors. Introduction to N tools, CNC programming and introduction, Hardware Interpolators, Software Interpolators, Recent developments of CNC systems for additive manufac

Unit-4

3D Modelling

Preparation of 3D-CAD model, Reverse engineering, Reconstruction of 3D-CAD model using reverse engineering, Part orientation and support generat error diagnostics, Slicing and Generation of codes for tool path, Surface preparation of materials.

Unit-5

additive manufacturing tooling accuracy

Support material removal, surface texture improvement, accuracy improvement, aesthetic improvement, preparation for use as a pattern, property enhancements using non-thermal and thermal techniques, Brief information on characterization techniques used in additive manufacturing, Applications of additive manufacturing in rapid prototyping, rapid manufacturing, rapid tooling, repairing and coating.

Text Books And Reference Books:

Units	Teaching Hours
Unit-1 Introduction	
Overview, Basic principle need and advantages of additive manufacturing, Procedure of product development in additive manufacturing, Classification of additive manufacturing processes, Materials used in additive manufacturing, Challenges in Additive Manufacturing.	9
Unit-2	
Z-Corporation 3D-printing, Stereolithography apparatus (SLA), Fused deposition modeling (FDM), Laminated Object Manufacturing (LOM), Selective deposition lamination (SDL), Ultrasonic consolidation, Selective laser sintering (SLS), Laser engineered net shaping (LENS), Electron beam free form fabrication (EBFFF), Electron beam melting (EBM), Plasma transferred arc additive manufacturing (PTAAM), Tungsten inert gas additive manufacturing (TIGAM), Metal inert gas additive manufacturing (MIGAM).	9
Unit-3	
Axes, Linear motion guide ways, Ball screws, Motors, Bearings, Encoders/ Glass scales, Process Chamber, Safety interlocks, Sensors. Introduction to NC/CNC/DNC machine tools, CNC programming and introduction, Hardware Interpolators, Software Interpolators, Recent developments of CNC systems for additive manufacturing	9
Unit-4	
Preparation of 3D-CAD model, Reverse engineering, Reconstruction of 3D-CAD model using reverse engineering, Part orientation and support generation, STL Conversion, STL error diagnostics, Slicing and Generation of codes for tool path, Surface preparation of materials.	9
Unit-5	
Support material removal, surface texture improvement, accuracy improvement, aesthetic improvement, preparation for use as a pattern, property enhancements using non-thermal and thermal techniques, Brief information on characterization techniques used in additive manufacturing, Applications of additive manufacturing in rapid prototyping, rapid manufacturing, rapid tooling, repairing and coating.	9

Essential Reading / Recommended Reading

Text Books:

T1. Gibson, I, Rosen, D W., and Stucker,B., Additive Manufacturing Methodologies: Rapid Prototyping to Direct Digital Manufacturing, Springer, 2010.

T2. Chua C.K., Leong K.F., and Lim C.S., "Rapid prototyping: Principles and applications", Third Edition, World Scientific Publishers, 2010.

T3. Chee Kai Chua, Kah Fai Leong, 3D Printing and Additive Manufacturing: Principles and Applications: Fourth Edition of Rapid Prototyping, World S

T4. Gebhardt A., "Rapid prototyping", Hanser Gardener Publications, 2003.

Reference Books:

1. Liou L.W. and Liou F.W., "Rapid Prototyping and Engineering applications: A tool box for prototype development", CRC Press, 2007
2. Kamrani A.K. and Nasr E.A., "Rapid Prototyping: Theory and practice", Springer, 2006
3. Mahamood R.M., Laser Metal Deposition Process of Metals, Alloys, and Composite Materials, Engineering Materials and Processes, Springer Inte 2018
4. Ehsan Toyserkani, Amir Khajepour, Stephen F. Corbin, "Laser Cladding", CRC Press, 2004

Online Resources:

W1. http://www.digimat.in/nptel/courses/video/112104204/L47.html

Evaluation Pattern

Total Hrs in a semester	CIA I - Evaluated out of (20/30)	CIA I cnverted to (10)	CIA II - Evaluated out of (50)	CIA II cnverted to (25/)	Mention Whether CIA II is Centralized exam or department level Assessment	CIA III - Evaluated out of (20/30)	CIA III cnverted to (10)	Total CIA	Total CIA is scaled down to 20/45/55/65	If CIA is final Submission -Evaluated out of	Is there CIA minimum, if yes give the minimum CIA	Att. Marks
75	20	10	10	25	Centralized	20	10	90	65	50	20	5

ME332 - BASIC THERMODYNAMICS (2022 Batch)

Total Teaching Hours for Semester:45 **No of**

Max Marks:100

Course Objectives/Course Description

- Expose the fundamentals of thermodynamics via real-world engineering examples.
- Understand the nature and role of the following thermodynamic properties of matter: internal energy, enthalpy, entropy, temperature, pressure an
- Represent various thermodynamic processes on appropriate thermodynamic diagrams, such as a temperature-entropy or pressure-volume diagra
- Represent a thermodynamic system by a control mass or control volume, distinguish the system from its surroundings, and identify work between the system and surroundings.
- Recognize and understand the different forms of energy and restrictions imposed by the first law of thermodynamics on conversion from one for
- Be able to apply the first law to a control mass or control volume at an instant of time or over a time interval.

Course Outcome

CO1: Explain the basic concepts of thermodynamics, work and heat, laws of thermodynamics, and ideal and real gases. (L2)

CO2: Illustrate the concepts of entropy and exergy on thermodynamic systems in engineering analysis. (L3)

CO3: Illustrate the laws of thermodynamics on boilers, heat pumps, refrigerators, heat engines, compressors, and nozzles. (L3)

CO4: Analyze the engineering problems on heat and work, heat engines, refrigeration, and entropy by applying laws of thermodynamics. (L4)

CO5: Assess the performance of engineering systems and processes based on thermodynamics relations and laws. (L5)

Unit-1 **Teaching Hours:9**

Fundamental Concepts & Zeroth Law

Revision of definition and scope. Microscopic and Macroscopic approaches. System {closed system} and Control Volume {open system}, Thermodynamic properties; intensive and extensive properties. Definitions of state, path, process and cycle. Quasi-static process.

Unit-1 **Teaching Hours:9**

Thermodynamic Equilibrium

Thermodynamic Equilibrium; Zeroth Law of Thermodynamics, Temperature; concepts, scales, measurement. Internal fixed points.

Unit-2 **Teaching Hours:9**

Work, Heat and First Law of Thermodynamics for Non-Flow Systems

Mechanics, definition of work and its limitations. Thermodynamic definition of work; examples, sign convention. PMM-I. Displacement work; expressions for displacement work in various processes through p-v diagrams.

Unit-2 **Teaching Hours:9**

First Law of Thermodynamics

Joule's experiments, equivalence of heat and work, Extension of the First law to non –cyclic processes, energy, energy as a property. Applications of first law for various thermodynamics processes

Unit-3 **Teaching Hours:9**

First Law of Thermodynamics

For flow systems, enthalpy, Specific heat Extension of the First law to control volume; steady state steady flow energy equation, important applications, Application of SFEE for different flow systems.

Unit-3 **Teaching Hours:9**

Second Law of Thermodynamics

Second Law of Thermodynamics: Devices Thermal reservoir. Direct heat engine; reserved heat engine, heat pump and refrigerator. Kelvin –Planck and Clasius's statement of Second law of Thermodynamic; equivalence of the two statements; PMM II.

Unit-4 **Teaching Hours:9**

Available and Unavailable Energy

Available and Unavailable Energy: Maximum Work, maximum useful work for a system and a control volume, availability of a system and a steadily flowing stream, irreversibility. Second law efficiency.

Unit-4 **Teaching Hours:9**

Entropy

Reversible and irreversible processes, Factors that make a process irreversible. Carnot cycle and principles. Thermodynamic temperature scale. Clausius's inequality. Entropy; a property, principle of increase of entropy

Unit-5 **Teaching Hours:9**

Ideal Gases

Ideal Gas Mixture: Dalton's law of additive pressures, Amagat's law of additive volumes, evaluation of properties. Analysis of various processes.

Unit-5 **Teaching Hours:9**

Real Gas

Real Gas: Introduction; Vander Waal's Equation Van der Waal's constants in terms of critical properties, law of corresponding states, compressibility factor; compressibility chart.

Text Books And Reference Books:

1. "Basic and Applied Thermodynamics" by P.K. Nag, McGraw Hill Education; 2nd edition 2017.

2. "Thermodynamics an engineering approach", by Yunus A. Cenegal and Michael A. Boles. Tata McGraw Hill Publications. 2002

Essential Reading / Recommended Reading

1. Engineering Thermodynamics. By Rajput, Laxmi Publications pvt ltd., 3rd Edi. 2007.

2. Engineering Thermodynamics by J.B. Jones and G.A.Hawkins, John Wiley and Sons.

3. Thermo Dynamics by S.C.Gupta, Pearson Edu. Pvt. Ltd., 1st Ed. 2005.

Evaluation Pattern

ASSESSMENT PATTERN FOR THEORY COURSE			
	Component	Assessed for	Scaled down to
1	CIA-1	20 M	10 M
2	CIA-2	50 M	25 M
3	CIA-3	20 M	10 M
4	Attendance	05 M	05 M
5	ESE	100 M	50 M
		TOTAL	100 M

Total Teaching Hours for Semester:75 **No of Lecture Hours/Week:5**

Max Marks:100 **Credits:4**

Course Objectives/Course Description

To study the behaviour of the material under different loading conditions, and study of various stress, strain and deformation on a material without undergoing failure or plastic deformation.

Course Outcome

CO-1: Demonstrate an understanding of stress-strain generated with in ductile and brittle material for simple and compound loading conditions. {L1, L2} {PO1, PO2}

CO-2: Determine the shear force, shear stress, bending moment and bending stress distribution for various beam with different loading conditions. {L1, L2, L3} {PO1, PO2, PO3}

CO-3: Finding the maximum deflection of beam by double integration and Macaulay?s method. {L1, L2, L4} {PO1, PO2, PO4}

CO-4: Understand the solid and hollow shaft behaviour subjected to pure torsion. {L1, L2, L3} {PO1, PO2, PO3}

CO-5: Illustrate the knowledge of calculating deformation in thick, thin cylinder and spherical shell.{L1, L2} {PO1, PO2}

Unit-1 **Teaching Hours:9**

Simple Stresses and Strains

Deformation in Solids, Hooke’s law, Stress Strain curve for ductile and brittle materials,Principle of super position, Shear stresses, Temperature Stress, Elastic constants and their relations - Volumetric, linear and shear strains.

Unit-1 **Teaching Hours:9**

Compound Stresses and Strains

Two-dimensional system, stress at a point on a plane, principal stresses and principal planes, Mohr’s circle of stress.

Activity: Determination of Plane stress 2D element using Matlab.

Unit-2 **Teaching Hours:9**

Bending moment and Shear Force Diagrams

Bending moment (BM) and shear force (SF) diagrams for cantilever, simply supported and over hanging beams for point load (PL), uniformly distributed load (UDL), Uniformly varying load (UVL) and Couple.

Unit-2 **Teaching Hours:9**

Deflection of Beams

Relationship between moment, slope and deflection, Double integration method, Macaulay’s method. Use of these methods to calculate slope and deflection for cantilever and simply supported beams subjected to point load, UDL, UVL and Couple.

Unit-3 **Teaching Hours:9**

Theory of bending stresses

Relationship between moment, slope and deflection, Double integration method, Macaulay’s method. Use of these methods to calculate slope and deflection for cantilever and simply supported beams subjected to point load, UDL, UVL and Couple.

Activity: Determination of Neutral axis for any regular or composite beam section using Matlab or Excel.

Unit-4 **Teaching Hours:9**

Simple Torsional Theory

Derivation of torsion equation and its assumptions. Applications of the equation of the hollow and solid circular shafts, torsional rigidity, Combined torsion. Analysis of close-coiled-helical springs.

Activity: Determination of Torsion in shaft using Matlab.

Unit-5 **Teaching Hours:9**

Thick and Thin Cylinders

Axial and hoop stresses in cylinders subjected to internal pressure, deformation of thick and thin cylinders, deformation in spherical shells subjected to internal pressure.

Text Books And Reference Books:

T1. Egor P. Popov, Engineering Mechanics of Solids, Prentice Hall of India, New Delhi, 2001.

T2. R. Subramanian, Strength of Materials, Oxford University Press, 2007.

T3. Ferdinand P. Been, Russel Johnson Jr and John J. Dewole, Mechanics of Materials, Tata Mc McGraw-Hill Publishing Co. Ltd., New Delhi 2005.

T4. R.C. Hibbeler, "Mechanics of materials", 9th Edition, Prentice-Hall. Pearson Edu., 2014.

T5. James. M. Gere; Stephe Timoshenko, "Mechanics of materials",2nd Edition CBS Publishers, 2016.

T6. Ferdinand P Beer; E. Russel Johnson; John T Dewolf; David F Mazurek; Sanjeev. Sanghi, "Mechanics of materials", Tata mc-grawhill- 2013.

Essential Reading / Recommended Reading

R1. S.S. Rattan, "Strength of Materials", 3rd Edition, Tata McGraw Hill, 2011.

R2. S.S. Bhavikatti, “Strength of Materials", 4th Edition, Vikas publications House Pvt. Ltd., 2013.

R3. K.V. Rao, G.C. Raju, “Mechanics of Materials", First Edition, 2007.

R4. Egor. P. Popov, "Engineering Mechanics of Solids", Pearson Edu. India, 2008.

R5. W.A. Nash, Schaum's Outlines Strength of Materials, Tata Mcgraw-Hill Publishing Company 2010.

R6 R.K. Rajput “Strength of Materials”, S.Chand & co Ltd. New Delhi, 2015.

R7 R.KBansal, “Strength of Materials”, Lakshmi Publication Pvt. Ltd, New Delhi, 2009.

Evaluation Pattern

ASSESSMENT PATTERN FOR COURSE THEORY WITH PRACTICAL				
	Component	Assessed for	Minimum marks to pass	Maximum marks
1	Theory CIA	30 M	-	30 M
2	Theory ESE	30 M	12 M	30 M
3	Practical CIA	35 M	14 M	35 M
4	Attendance	05 M	-	05 M
5	Aggregate	100 M	40 M	100 M

ME334P - MANUFACTURING PROCESSES (2022 Batch)

Total Teaching Hours for Semester:75 **No of Lecture Hours/Week:5**

Max Marks:100 **Credits:4**

Course Objectives/Course Description

- To provide basic knowledge on manufacturing processes and selection of the process for production.
- To provide basic knowledge about the casting process casting defects, melting furnaces, and Moulding techniques.
- To gain sound knowledge about the welding process and its application in fabrication areas.
- To provide basic knowledge about various machining processes and their applications e.g. Lathe, Drilling, Milling, Grinding etc.

Course Outcome

CO1- Identify the various processes like casting, welding, machining and other advanced manufacturing processes involved in the manufactured product. [L2]

CO2 - Explain various process parameters and their effect on manufacturing the product. [L2]

CO3 - Distinguish advanced manufacturing methods to develop a suitable product. [L4]

CO4 - Figure out the application of modernization in machining and various new manufacturing methods. [L3]

CO5 - Classify manufacturing processes and tooling requirements in the manufacturing industry. [L2]

CO6 - Perform the operations using various machine tools to produce components. [L3]

Unit-1 **Teaching Hours:10**

Joining/Fastening Processes

Joining/Fastening Processes: Physics of welding, brazing and soldering; design considerations in welding, Solid and liquid state joining processes; Adhesive bonding.

Unit-1 **Teaching Hours:10**

Metal Casting

Metal Casting: Metal casting processes and equipment, Heat transfer and solidification, shrinkage, riser design, casting defects and residual stresses.

Unit-2 **Teaching Hours:8**

Metal Cutting Processes

Metal cutting: Single and multi-point cutting; Orthogonal cutting, various force components: Chip formation, Tool wear and tool life, Surface finish and integrity, Machinability, Cutting tool materials,

Cutting fluids, Coating; Turning, Drilling, Milling and finishing processes, Introduction to CNC machining.

Unit-3 **Teaching Hours:7**

Additive Manufacturing

Additive Manufacturing: Rapid prototyping and rapid tooling.

Unit-3 **Teaching Hours:7**

Metal Forming

Metal Forming: Introduction to bulk and sheet metal forming, plastic deformation and yield criteria; fundamentals of hot and cold working processes; load estimation for bulk forming(forging, rolling, extrusion, drawing) and sheet forming (shearing, deep drawing, bending) principles of powder metallurgy.

Unit-4 **Teaching Hours:9**

Electro-Thermal Energy

Electro-Thermal Energy: Electrical Discharge Machining, principle and processes parameters, MRR, surface finish, tool wear, dielectric, power and control circuits, wire EDM.

Unit-4 **Teaching Hours:9**

Mechanical Energy

Mechanical Energy: Abrasive Jet Machining, Water Jet Machining, Abrasive Water Jet Machining, Ultrasonic Machining, principles and process parameters.

Unit-5 **Teaching Hours:11**

Newer Machining Processes

Newer Machining Processes: Laser Beam Machining (LBM), Plasma Arc Machining (PAM) and Electron Beam Machining (EBM).

Unit-5 **Teaching Hours:11**

Electro-Chemical Process

Electro-Chemical Process: Electro-chemical machining (ECM), etchant & maskant, process parameters, MRR and surface finish.

Text Books And Reference Books:

T1. J. P. Kaushish, “Manufacturing Processes”, 2nd Edition, Prentice-Hall of India Pvt. Ltd; 2010, ISBN-13: 978-8120340824.

T2. P. N. Rao, “Manufacturing Technology: Foundry, Forming and Welding”, 4th Edition Volume 1, McGraw Hill Publications, 2013.

T3. Dr. K. Radhakrishna "Manufacturing process 1 (Casting & Welding process)" 8th Edition. Sudha publications, 2010.

T4. P C Pandey and H s Shan, “Modern Machining Processes”, Tata McGraw-Hill Publications, 1993.

T5. Hajra Choudhury S K, “Elements of Workshop Technology” 13th Edition, Volume 2, Machine Tools, India Book Distributing Company Calcutta, 2010, ISBN-8185099154. 97881850991565.

T6. Milton C. Shaw, “Metal Cutting Principles”, 2nd Edition, Oxford University Press, 2008.

Essential Reading / Recommended Reading

R1. Steven R Schmid and Serope Kalpak Jain, “Manufacturing Engineering and Technology”, Pearson Publications, 2001.

R2. Geoffrey Boothroyd, “Fundamentals of Metal Machining and Machine Tools”, 3rd Edition, CRC Press, 1988, ISBN: 0824778529, 9780824778521.

R3. R K Jain, “Production Technology: Manufacturing Processes, Technology and Automation” 17th Edition, Khanna Publishers, 2002.

Evaluation Pattern

ASSESSMENT PATTERN FOR COURSE THEORY WITH PRACTICAL				
	Component	Assessed for	Minimum marks to pass	Maximum marks
1	Theory CIA	30 M	-	30 M
2	Theory ESE	30 M	12 M	30 M
3	Practical CIA	35 M	14 M	35 M
4	Attendance	05 M	-	05 M
4	Aggregate	100 M	40 M	100 M

ME335P - INSTRUMENTATION AND CONTROL (2022 Batch)

Total Teaching Hours for Semester:75 **No of Lecture Hours/Week:5**

Max Marks:100 **Credits:4**

Course Objectives/Course Description

1. To provide basic knowledge about measurement systems and their components.

2. To learn about various sensors used for the measurement of mechanical quantities.

3. To learn about system stability and control.

4. To integrate the measurement systems with the process for process monitoring and control.

Course Outcome

CO1: Interpret the parameters of Transducers. [L3]

CO2: Operate & infer the values of Torque measurement equipment. [L3]

CO3: Interpret the readings of the Cathode ray oscilloscope. [L3]

CO4: Compute the strain from the strain gauge equipment. [L3]

CO5: Examine the Line standards by slip gauges.[L3]

CO6: Perform measuring processes using various measuring instruments. [L4]

Unit-1 **Teaching Hours:9**

Measurement Systems and Performance

Definition, significance of measurement, generalized measurement system, definitions and concept of accuracy, precision, calibration, threshold, sensitivity, hysterisis, repeatability, linearity, loading effect, system response-times delay. Errors in measurement, classification of errors, primary and secondary transducers, electrical, mechanical, electronic transducers, advantages of each type transducers.

Unit-2 **Teaching Hours:10**

Instrumentation System Elements

Measurement of Force and Torque: Principle, analytical balance, platform balance, proving ring. Torque measurement, Prony brake, hydraulic dynamometer.

Pressure Measurements: principle, use of elastic merijbers, Bridgeman gauge, Mcloed gauge, Pirani gauge, Surface Finish Metrology

Unit-3 **Teaching Hours:8**

Signal Processing and Conditioning

Mechanical systems, electronic amplifiers and telemetry. Terminating devices, mechanical, cathode ray oscilloscope, oscillographs, X-Y plotters, Machine tool Metrology, Introduction to atomic force microscopy (AFM), Scanning tunnelling microscopy (STM), Nano metrology

Unit-4 **Teaching Hours:10**

Control Systems

Temperature Measurement: Resistance thermometers, thermocouple, law of thermo couple, materials used for construction, pyrometer, optical pyrometer.

Strain Measurements: strain gauge, preparation and mounting of strain gauges, gauge factor, methods of strain measurement.

Unit-5 **Teaching Hours:8**

Standards of Measurement

Definition and Objectives of metrology, Standards of length-International prototype meter, Imperial standard yard, Wave length standard, subdivision of standards, line and end standard, calibration of end bars (Numerical), Slip gauges, Wringing phenomena, Legal Metrology, Care of Measuring Instruments-Reliability.

Text Books And Reference Books:

T1. Thomas G. Beckwith , Roy D. Marangon, John H. Lienhard ,“Mechanical Measurements”, 6th Edition, Pearson education, 2014

T2. R K Jain, “Engineering Metrology”,17thEdition, ISBN: 717409024X; ©1999 Khanna Publications Delhi; 2009

T3. Connie L Dotson, “Fundamentals of Dimensional Metrology” 5th edition, Delmar Cengage Learning, 2006

Essential Reading / Recommended Reading

R1. I C Gupta,"A Text Book Of Engineering Metrology",7th Edition, Dhanpat Rai Publications (P) Ltd.-New Delhi,

R2. Jerry Faulk, Al Sutko,"Industrial Instrumentation"1st Edition, ISBN-13: 978-0827361256, Thompson Asia Pvt. Ltd.2002.

R3. Ernest, "Measurement Systems Application", 1st Edition, ISBN-13: 978-0070173385, McGraw-Hill Book Company.

R4. R S Sirohi, "Mechanical measurements"3rd Edition, ISBN-8122403832, New Age Publications, 1991.

Evaluation Pattern

ASSESSMENT PATTERN FOR COURSES THEORY WITH PRACTICAL				
	Component	Assessed for	Minimum marks to pass	Maximum marks
1	Theory CIA	30 M	-	30 M
2	Theory ESE	30 M	12 M	30 M
3	Practical CIA	35 M	14 M	35 M
4	Attendance	05 M	-	05 M
4	Aggregate	100 M	40 M	100 M

CY421 - CYBER SECURITY (2022 Batch)

Total Teaching Hours for Semester:30 **No of Lecture Hours/Week:2**

Max Marks:0 **Credits:0**

Course Objectives/Course Description

This mandatory course is aimed at providing a comprehensive overview of the different facets of Cyber Security. In addition, the course will detail into specifics of Cyber Security with Cyber Laws both in Global and Indian Legal environments

Course Outcome

CO1: Describe the basic security fundamentals and cyber laws and legalities.

CO2: Describe various cyber security vulnerabilities and threats such as virus, worms, online attacks, Dos and others.

CO3: Explain the regulations and acts to prevent cyber-attacks such as Risk assessment and security policy management.

CO4: Explain various vulnerability assessment and penetration testing tools.

CO5: Explain various protection methods to safeguard from cyber-attacks using technologies like cryptography and Intrusion prevention systems.

Unit-1 **Teaching Hours:6**

UNIT 1

Security Fundamentals-4 As Architecture Authentication Authorization Accountability, Social Media, Social Networking and Cyber Security.Cyber Laws, IT Act 2000-IT Act 2008-Laws for Cyber-Security, Comprehensive National Cyber-Security Initiative CNCI – Legalities

Unit-2 **Teaching Hours:6**

UNIT 2

Cyber Attack and Cyber Services Computer Virus – Computer Worms – Trojan horse.Vulnerabilities - Phishing - Online Attacks – Pharming - Phoarging – Cyber Attacks - Cyber Threats - Zombie- stuxnet - Denial of Service Vulnerabilities - Server Hardening-TCP/IP attack-SYN Flood

Unit-3 **Teaching Hours:6**

UNIT 3

Cyber Security Management Risk Management and Assessment - Risk Management Process - Threat Determination Process -Risk Assessment - Risk Management Lifecycle.Security Policy Management - Security Policies - Coverage Matrix Business Continuity Planning - DisasterTypes - Disaster Recovery Plan - Business Continuity Planning Process

Unit-4 **Teaching Hours:6**

UNIT 4

Vulnerability - Assessment and Tools: Vulnerability Testing - Penetration Testing Black box- white box.Architectural Integration: Security Zones - Devicesviz Routers, Firewalls, DMZ. Configuration Management - Certification and Accreditation for Cyber-Security.

Unit-5 **Teaching Hours:6**

UNIT 5

Authentication and Cryptography: Authentication - Cryptosystems - Certificate Services, Securing Communications: Securing Services - Transport – Wireless - Steganography and NTFS Data Streams. Intrusion Detection and

Prevention Systems: Intrusion - Defense in Depth - IDS/IPS -IDS/IPS Weakness and Forensic AnalysisCyber Evolution: Cyber Organization – Cyber Future

Text Books And Reference Books:

R1. Matt Bishop, "Introduction to Computer Security", Pearson, 6th impression, ISBN: 978-81-7758-425-7.

R2. Thomas R, Justin Peltier, John, "Information Security Fundamentals", Auerbach Publications.

R3. AtulKahate, "Cryptography and Network Security", 2nd Edition, Tata McGrawHill.2003

R4. Nina Godbole, SunitBelapure, "Cyber Security", Wiley India 1st Edition 2011

R5. Jennifer L. Bayuk and Jason Healey and Paul Rohmeyer and Marcus Sachs, "Cyber Security Policy Guidebook", Wiley; 1 edition , 2012

R6. Dan Shoemaker and Wm. Arthur Conklin, "Cyber security: The Essential Body Of Knowledge", Delmar Cengage Learning; 1 edition, 2011

R7. Stallings, "Cryptography & Network Security - Principles & Practice", Prentice Hall, 6th Edition 2014

Essential Reading / Recommended Reading

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Evaluation Pattern

Only CIA will be conducted as per the University norms. No ESE

Maximum Marks : 50

HS421 - PROFESSIONAL ETHICS (2022 Batch)

Total Teaching Hours for Semester:30 **No of Lecture Hours/Week:2**

Max Marks:50 **Credits:2**

Course Objectives/Course Description

This paper deals with the various organizational behaviours like learning, perception, motivation and method of managing stress and conflicts and the basic principles of communication.

Course Outcome

CO1: Understand the importance of Values and Ethics in their personal lives and professional careers. (L2)

CO2: Learn the rights and responsibilities as an employee, team member and a global citizen. (L2)

CO3: Estimate the impact of self and organization?s actions on the stakeholders and society. (L3)

CO4: Develop ethical behaviour under all situations. (L3)

CO5: Appreciate the significance of Intellectual Property as a very important driver of growth and development in today?s world and be able to statutorily acquire and use different types of intellectual property in their professional life. (L2)

Unit-1 **Teaching Hours:6**

Introduction to Professional Ethics

Definition, Nature, Scope- Moral Dilemmas- moral Autonomy-Kohlberg's theory- Gilligan's theory, Profession Persuasive, Definitions, Multiple motives, Models of professional goals. Moral Reasoning and Ethical theories – Professional Ideals and Virtues- Theories of Right Action, Self-interest, Customs and Regions- Use of Ethical Theories.

Unit-2 **Teaching Hours:6**

Engineering as Social Experimentation and Responsibility

For Safety Engineering as experimentation- Engineers as responsible experimenters, the challenger case, Codes of Ethics, A balanced outlook on the law. Concept of safety and risk, assessment of safety and risk-risk-benefit analysis and reducing the risk- three-mile island, Chernobyl and safe exists.

Unit-3 **Teaching Hours:6**

Global Issues and Introduction To Intellectual Property

Multinational corporations- Environmental ethics- Computer ethics and Weapons developments. Meaning and Types of Intellectual Property, Intellectual Property. Law Basics, Agencies responsible for intellectual property registration, International Organizations, Agencies and Treaties, Importance of Intellectual Property Rights.

Unit-4 **Teaching Hours:6**

Foundations of Trademarks

Meaning of Trademarks, Purpose and Functions of Trademarks, types of Marks, Acquisition of Trademark rights, Common Law rights, Categories of Marks, Trade names and Business Name, Protectable Matter, Exclusions from Trademark Protection. work process.

Unit-5 **Teaching Hours:6**

Foundations of Copyrights Laws and Patent Laws

Meaning of Copyrights, Common Law rights and Rights under the 1976 copyright Act, Recent developments of the Copyright Act, The United States Copyright Office. Meaning of Patent Law, Rights under Federal Law, United States patent and Trademark Office, Patentability, Design Patents, Plants patents, Double Patenting.

Text Books And Reference Books:

T1. Jayashree Suresh &B.S.Raghavan "Human values and Professional Ethics", S. Chand, 2009.

T2. Govindarajan, Natarajan and Senthilkumar "Engineering Ethics", PHI:2009.

Essential Reading / Recommended Reading

R1. Nagarajan "A Text Book on Professional Ethics and Human values", New Age International, 2009.

R2. Charles &Fleddermann "Engineering Ethics", Pearson, 2009.

R3. Rachana Singh Puri and Arvind Viswanathan, I.K."Practical Approach to Intellectual Property rights", International Publishing House, New Delhi. 2010.

R4. A.B.Rao "Business Ethics and Professional Values", Excel, 2009.

Evaluation Pattern

ASSESSMENT PATTERN FOR PROFESSIONAL ETHICS COURSE			
	Component	Assessed for	Scaled down to
1	CIA	50	25
2	ESE	50	25
		TOTAL	50

MAHO431DMP - COMPUTER AIDED ENGINEERING (2022 Batch)

Total Teaching Hours for Semester:75 **No of Lecture Hours/Week:4**

Max Marks:100 **Credits:4**

Course Objectives/Course Description

Course objectives:

•To introduce the Industry experience to student in product design and developments.

•To know the stages involved in any product design and development.

•To develop the student's skills to solve the problems facing while geometry modelling and FE modelling.

•To guide the students in selection of geometry for its validation for required application.

•To enhance the problem analysis knowledge in modelling and analysis.

•To improve the knowledge in identify the problem and selection of analysis method and hence to validate the output of CAE tools.

Course Outcome

CO1: Understand the possibilities of CAD modelling and analysis.

CO2: Apply geometrical modelling to create solid models and its boundary conditions

CO3: Apply the knowledge of static and dynamic analysis on solid models.

CO4: Apply the knowledge of loading and boundary conditions on part models.

CO5: Validate the results of FEA and apply error correction on solid models created.

Unit-1 **Teaching Hours:9**

INTRODUCTION:

CAD and Analysis tools. Geometry modelling, Finite Element Modelling, Selection of geometry, Selection of element types, Loads and Boundary conditions, Validation of results.

Unit-2 **Teaching Hours:9**

Geometry Modelling

Modelling a point, line, surface and solids. Boolean operations, assembly of parts. Import and export of geometry. Introduction to GD&T.

Unit-3 **Teaching Hours:9**

Finite Element Modelling:

Selection/disfeaturing of geometry for FE modelling, dividing surfaces and cutting of solids. Setting preferences. Element qualities and their standard values required for required analysis/results. Import and export of FEM files for analysis and results review.

Unit-4 **Teaching Hours:9**

Loads and boundary conditions:

Selection of nodes, surfaces. Local coordinate systems, assigning the coordinate system to nodes. Selection or estimation of loads in terms of point, surface and body loads. How to apply inertia loads.

Solution control and output requests: Defining required output parameters/results other than standard output results. Defining the solution parameters like, end time, timesteps, load steps, etc.,

Unit-5 **Teaching Hours:9**

Error rectification Verification/Validation of output results

Error rectification: Study on common type of errors while solving FE problems. Understanding the error types. How to address these errors.

Verification/Validation of output results: How to validate results from FEA. Steps involved in verification of results. Identifying reason for deviation in results as compared to calculated results through classical methods or lab test results. Modifying/simplifying the input data based on output results.

Text Books And Reference Books:

1. K L Narayana, P Kannaiah & K Venkata Reddy, “Machine Drawing” 5th edition, new

age International Publishers 2016.

2. N.D.Bhat & V.M.Panchal, “A Primer on Computer Aided Machine Drawing-2007”,

VTU, Belgaum, ‘Machine Drawing', 2012.

Essential Reading / Recommended Reading

Reference Books:

R1. S. Trymbaka Murthy,”A Text Book of Computer Aided Machine Drawing”, CBS

Publishers, New Delhi, 2007

R2. K.R. Gopala Krishna, “Machine Drawing”, Subhash Publication, 2012.

R3. Goutam Pohit & Goutham Ghosh, “Machine Drawing with Auto CAD”,1st Indian print

Pearson Education, 2007

R4. Sham Tickoo, “Auto CAD 2015 for engineers and designers”, Dream tech 2015

R5. N. Siddeshwar, P. Kanniah, V.V.S. Sastri, “Machine Drawing”, published by Tata Mc

GrawHill,2006

R6. Alex Krulikowski, “Fundamentals of Geometric Dimension & Tolerancing”, 6th edition, Goodheart-Willcox Pub ,25 November 2014

Evaluation Pattern

SL no	Component	Assessment for	Scaled- down to
1	CIA-1	20 M	10 M
2	CIA-2	50 M	25 M
3	CIA-3	20 M	10 M
4	Attendance	05 M	05 M
5	ESE	100 M	50M
		Total	100 M

ME431 - APPLIED THERMODYNAMICS (2022 Batch)

Total Teaching Hours for Semester:45 **No of Lecture Hours/Week:3**

Max Marks:100 **Credits:3**

Course Objectives/Course Description

- To make the students understand thermodynamic principles, in various applications involving machines converting heat into work and work into heat. Some of such applications covered in this course are
  - Steam engines
  - Gas turbine and jet propulsion
  - Compressors

- Refrigerators and air conditioners
- To quantify the behavior of power plants based on the Rankine cycle, including the effect of enhancements such as superheat, reheat and regeneration;
- To quantify the performance of power plants based on the Brayton cycle, including the effects of enhancements such as reheat, regeneration and intercooling.
- To quantify the performance of refrigeration and heat pumps

Course Outcome

CO1: Explain the basic concepts of pure substances, vapour power cycles, gas power cycles, propulsion systems, compressors, and refrigeration systems through thermodynamics principles. CO1: Explain the basic concepts of pure substances, vapour power cycles, gas power cycles, propulsion systems, compressors, and refrigeration systems through thermodynamics principles. (L2)

CO2: Illustrate the concepts of thermodynamic principles and relations between vapour power cycles and gas power cycles. (L3)

CO3: Evaluate the psychometric properties of refrigerants using psychometric charts and explain the working of air-conditioning systems. (L3)

CO4: Illustrate the thermodynamics relation and laws on compressors and refrigeration systems in engineering analysis. (L3)

CO5: Analyze the engineering problems on gas power cycles, vapour cycles, propulsive systems, compressors and refrigeration systems by basic thermodynamics principles. (L4)

Unit-1 **Teaching Hours:9**

VAPOUR POWER CYCLE

Carnot cycle, Rankine cycle, Comparison of Carnot cycle and Rankine cycle, Efficiency of Rankine cycle, Relative efficiency, Effect of superheat, boiler and condenser pressure on performance of Rankine cycle

Unit-1 **Teaching Hours:9**

PROPERTIES OF PURE SUBSTANCES

Formation of steam, Phase changes, Properties of steam, Use of Steam Tables, Study of P-V, T-S and Mollier diagram for steam, Dryness fraction and its determination, Study of steam calorimeters (Barrel, Separating, Throttling and combined). Non-flow and Steady flow vapour processes, Change of properties, Work and heat transfer.

Unit-2 **Teaching Hours:9**

GAS POWER CYCLE AND GAS TURBINE

Classification of Gas Turbines, Analysis of open cycle gas turbine cycle. Advantages and Disadvantages of closed cycle. Work done, condition for maximum work, methods to improve thermal efficiency.

Unit-2 **Teaching Hours:9**

JET PROPULSION

Introduction to the principles of jet propulsion, Turbojet and turboprop engines & their processes, Principle of rocket propulsion, Introduction to Rocket Engine.

Unit-3 **Teaching Hours:9**

ROTARY COMPRESSORS

Vane compressor, roots blower - Comparison between reciprocating compressors and rotary compressors.

Unit-3 **Teaching Hours:9**

RECIPROCATING COMPRESSORS

Operation of a single stage reciprocating compressors. Work input through p-v diagram. Effect of clearance and volumetric efficiency. Adiabatic, isothermal and mechanical efficiencies. Multi-stage compressor, saving in work, optimum intermediate pressure, inter-cooling, minimum work for compression.

Unit-4 **Teaching Hours:9**

REFRIGERATION

History and applications, air cycle refrigeration; reversed Carnot cycle, reversed Brayton cycle. Vapour absorption refrigeration system. Steam jet refrigeration.

Unit-4 **Teaching Hours:9**

VAPOUR COMPRESSION REFRIGERATION

Description, analysis, refrigerating effect, capacity, power required, units of refrigeration, COP. Refrigerants and their desirable properties

Unit-5 **Teaching Hours:9**

AIR CONDITIONINIG

Construction and use of psychometric chart. Analysis of various processes; heating, cooling, dehumidifying and humidifying. Adiabatic mixing of stream of moist air. Summer and winter air - conditioning. Problems using charts only.

Unit-5 **Teaching Hours:9**

PSYCHOMETRICS

Atmospheric air and psychometric properties; Dry bulb temperature, wet bulb temperature, dew point temperature; partial pressures, specific and relative humidifies and the relation between the two Enthalpy and adiabatic saturation temperature. Problems without charts only.

Text Books And Reference Books:

T1.P.K.Nag, "Basic and Applied Thermodynamics" Tata McGraw Hill Pub. Co., 10th Edition, 2009.

T2. G.J.Van Wylen and R.E.Sonntag," Fundamental of Classical Thermodynamics", 4th Edition edition, John Wiley & Sons,14 June 1994.

Essential Reading / Recommended Reading

R1. Yunus, A.Cenegal and Michael A.Boles," Thermodynamics -An Engineering Approach",8th edition, Tata McGraw Hill Pub. Co., 2014.

R2. R.K.Hegde and Niranjan Murthy ," Applied Thermodynamics", Sapna Book House,2009.

Evaluation Pattern

ASSESSMENT PATTERN FOR THEORY COURSE			
	Component	Assessed for	Scaled-down to
1	CIA-1	20 M	10 M
2	CIA-2	50 M	25 M
3	CIA-3	20 M	10 M
4	Attendance	05 M	05 M
5	ESE	100 M	50 M
		TOTAL	100 M

ME432P - MATERIAL ENGINEERING (2022 Batch)

Total Teaching Hours for Semester:75 **No of Lecture Hours/Week:5**

Max Marks:100 **Credits:4**

Course Objectives/Course Description

- Understanding of the correlation between the internal structure of materials, their mechanical properties and various methods to quantify their mechanical integrity and failure criteria.
- To provide a detailed interpretation of equilibrium phase diagrams
- Learning about different phases and heat treatment methods to tailor the properties of Fe-C alloys.

Course Outcome

CO1: Explain the different types of crystal structures and describe the various mechanical properties of material

CO2: Enumerate the various static failure theories and explain the concept of fracture mechanics. [L3]

CO3: Elucidate the different types of phase diagrams. [L3]

CO4: Describe the various heat treatment methods and state their advantages. [L3]

CO5: Discuss the composition and properties of ferrous and non-ferrous alloys. [L3]

CO6: Demonstrate and explain the various sand testing methods. [L3]

Unit-1 **Teaching Hours:13**

Crystal Structure & Mechanical Property Measurement

Crystal Structure: Unit cells, Metallic crystal structures, Ceramics. Imperfection in solids: Point, line, interfacial and volume defects; dislocation strengthening mechanisms and slip systems, critically resolved shear stress

Mechanical Property Measurement: Tensile, compression and torsion tests; Young's modulus, relations between true and engineering stress-strain curves, generalized Hooke's law, yielding and yield strength, ductility, resilience, toughness and elastic recovery; Hardness: Rockwell, Brinell and Vickers and their relation to strength

Unit-2 **Teaching Hours:9**

Static Failure Theories & Fracture Mechanics

Static Failure Theories: Ductile and brittle failure mechanisms, Tresca, Von-mises, Maximum normal stress, Mohr-Coulomb and Modified Mohr-Coulomb;

Fracture mechanics: Introduction to Stress-intensity factor approach and Griffith criterion. Fatigue failure: High cycle fatigue, Stress-life approach, SN curve, endurance and fatigue limits, effects of mean stress using the Modified Goodman diagram; Fracture with fatigue, Introduction to non-destructive testing (NDT)

Unit-3 **Teaching Hours:7**

Phase Diagrams

Alloys, substitutional and interstitial solid solutions- Phase diagrams: Interpretation of binary phase diagrams and microstructure development; eutectic, peritectic, peritectoid and monotectic reactions. Iron Iron-carbide phase diagram and microstructural aspects of ledeburite, austenite, ferrite and cementite, cast iron.

Unit-4 **Teaching Hours:7**

Heat Treatment of Steel

Heat Treatment of Steel: Annealing, tempering, normalising and spheroidising, isothermal transformation diagrams for Fe-C alloys and microstructure development. Continuous cooling curves and interpretation of final microstructures and properties- austempering, martempering, case hardening, carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction hardening, vacuum and plasma hardening.

Unit-5 **Teaching Hours:9**

Ferrous and Non-Ferrous Alloys

Alloying of steel, properties of stainless steel and tool steels, maraging steels- cast irons; grey, white, malleable and spheroidal cast irons- copper and copper alloys; brass, bronze and cupro-nickel; Aluminium and Al-Cu – Mg alloys- Nickel-based superalloys and Titanium alloys

Text Books And Reference Books:

T1. W. D. Callister, 2006, “Materials Science and Engineering-An Introduction”, 6th Edition, Wiley India.

T2. Kenneth G. Budinski and Michael K. Budinski, “Engineering Materials”, Prentice Hall of India Private Limited, 4th Indian Reprint, 2002.

T3. V. Raghavan, “Material Science and Engineering’, Prentice Hall of India Private Limited, 1999.

T4. U. C. Jindal, “Engineering Materials and Metallurgy”, Pearson, 2011.

Essential Reading / Recommended Reading

R1. George Dieter, 2013, “Mechanical Metallurgy”, McGrew Hill Education.

R2. Y.Lakhtin, “Engineering Physical Metallurgy”, New Delhi CBS Publishers and Distributors 1998.

Evaluation Pattern

ASSESSMENT PATTERN FOR COURSES THEORY WITH PRACTICAL				
	Component	Assessed for	Minimum marks to pass	Maximum marks
1	Theory CIA	30 M	-	30 M
2	Theory ESE	30 M	12 M	30 M
3	Practical CIA	35 M	14 M	35 M
4	Attendance	05 M	-	05 M
5	Aggregate	100 M	40 M	100 M

ME433P - FLUID MECHANICS AND FLUID MACHINES (2022 Batch)

Total Teaching Hours for Semester:75 **No of Lecture Hours/Week:5**

Max Marks:100 **Credits:4**

Course Objectives/Course Description

- To learn about the application of mass and momentum conservation laws for fluid flows.
- To understand the importance of dimensional analysis.
- To obtain the velocity and pressure variations in various types of simple flows.
- To analyse the flow in water pumps and turbines.

Course Outcome

CO1: Differentiate various properties of fluids and estimate pressure drop using governing laws. (L2)

CO2: Solve fluid-related problems using the knowledge of fluid statics, kinematics and dynamics. (L2)

CO3: Calculate the energy losses across pipe bends, fittings, and sub-sections. (L3)

CO4: Explain the concept of the boundary layer in fluid flow and analyze dimensionless numbers using the Buckingham Pi-theorem method (L4)

CO5: Estimate the drag and lift coefficients in external flow using CFD techniques (L5)

CO6: Predict pressure drop, coefficient of friction, and coefficient of discharge through experimentation on venturimeter, Notches, and vanes. (L5)

Unit-1 **Teaching Hours:9**

STATICS

Fluid Statics: Buoyancy, center of buoyancy, meta center and meta centric heightits application in shipping, stability of floating bodies

Unit-1 **Teaching Hours:9**

INTRODUCTION TO FLUID MECHANICS

Basics: Introduction, Properties of fluids-mass density, weight density, specific volume, specific gravity, viscosity, surface tension, capillarity, vapour pressure, compressibility and bulk modulus. Pascal's law, Absolute, gauge, atmospheric and vacuum pressures. Pressure measurement by simple, differential manometers and mechanical gauges.

Unit-2 **Teaching Hours:9**

FLUID DYNAMICS

Fluid Dynamics: Euler's equation, Integration of Euler's equation to obtain Bernoulli's equation, Bernoulli's theorem, Application of Bernoulli's theorem such as venturi meter, orifice meter, rectangular and triangular notch, pitot tube, orifices etc., related numericals.

Unit-2 **Teaching Hours:9**

FLUID KINEMATICS

Fluid Kinematics: Types of Flow-steady , unsteady, uniform, non-uniform, laminar, turbulent, one, two and three dimensional, compressible, incompressible, rotational, irrotational, stream lines, path lines, streak lines, velocity components, convective and local acceleration, velocity potential, stream function, continuity equation in Cartesian co-ordinates.

Unit-3 **Teaching Hours:9**

MAJOR AND MINOR LOSSES IN PIPES

Major and Minor losses in Pipes: Energy consideration in pipe flow, Loss of Pressure Head due to Fluid Friction, Chezy's equation, Darcy Weishach formula, major and minor losses in pipes, Moody equation/ diagram. Pipes in series, parallel, equivalent pipe, Related Numericals and simple pipe design problems.

Unit-4 **Teaching Hours:9**

FLOW OVER BODIES

Flow Over Bodies: Basic concept of Lift and Drag, Types of drag, Co-efficient of drag and lift, streamline body and bluff body, flow around circular bodies and airfoils, Lift and drag on airfoil, Numerical problems.

Unit-4 **Teaching Hours:9**

DIMENSIONAL ANALYSIS

Dimensional Analysis: Need for dimensional analysis, Dimensions and units, Dimensional Homogeneity and dimensionless ratios, methods of dimensional analysis, Rayleigh's method, Buckingham Pi theorem, Numerical problems.

Unit-5 **Teaching Hours:9**

INTRODUCTION TO CFD

Introduction to CFD: Necessity, limitations, philosophy behind CFD, and applications.

Unit-5 **Teaching Hours:9**

COMPRESSIBLE FLOWS

Compressible Flows: Introduction, thermodynamic relations of perfect gases, internal energy and enthalpy, speed of sound, pressure field due to a moving source, basic Equations for one-dimensional flow, stagnation and sonic Properties, normal and oblique shocks.

Text Books And Reference Books:

T1. Bansal. R.K, "Fluid Mechanics and Hydraulics Machines", 9th edition, Laxmi publications {P} Ltd., New Delhi,2017.

T2. Yunus A Cengel & John M. Cimbala, Fluid Mechanics, Tata McGraw Hill Edition New Delhi, 2013.

Essential Reading / Recommended Reading

R1. White. F.M, "Fluid Mechanics", Tata McGraw-Hill, 8th Edition, New Delhi, 2016.

R2. Streeter V.L., Benjamin Wylie, "Fluid Mechanics", Mc Graw Hill Book Co., New Delhi,1999.

R3. Robert W. Fox, Philip J. Pritchard, Alan T. McDonald, "Introduction to Fluid Mechanics", Wiley India Edition, Wiley Student Edition 8th 2014.

R4. Modi P.N, & Seth S.M, "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi, 14th edition, 2002.

R5. Shiv Kumar, "Fluid Mechanics & Fluid Machines: Basic Concepts & Principles", Ane Books Pvt. Ltd., New Delhi, 2010.

Evaluation Pattern

ASSESSMENT PATTERN FOR COURSES THEORY WITH PRACTICAL				
	Component	Assessed for	Minimum marks to pass	Maximum marks
1	Theory CIA	30 M	-	30 M
2	Theory ESE	30 M	12 M	30 M
3	Practical CIA	35 M	14 M	35 M
4	Attendance	05 M	-	05 M

4	Aggregate	100 M	40 M	100 M

ME434 - ENTREPRENEURSHIP DEVELOPMENT (2022 Batch)

Total Teaching Hours for Semester:30 **No of Lecture Hours/Week:2**

Max Marks:50 **Credits:2**

Course Objectives/Course Description

- To develop entrepreneurship qualities and skills.
- To motivate young engineers to identify new business opportunities in the emerging area of science and technology and to understand the steps involved in setting up the business.
- To identify the source of finance, loans, capital structure, costing and application of it in new business venture.
- To understand the demand forecasting, product life cycle, sales strategies, distribution channel and adventuring in business.
- To understand the concept, magnitude, causes and measures for small scale business enterprises.

Course Outcome

CO1: Explain the concept, magnitude, causes and measures in the institutional support to the entrepreneurs. [L2]

CO2: Illustrate the principles of marketing and growth strategies based on the assessment of the market. [L2]

CO3: Identify the source of information and explain the steps involved in setting up a business. [L3]

CO4: Make use of available source of finance, working capital, costing, taxation, pricing and procedures involved in the business. [L3]

CO5: Develop the entrepreneurship skills and identify the traits for an entrepreneur. [L3]

Unit-1 **Teaching Hours:6**

ENTREPRENEURSHIP

Entrepreneurship: Historical perspective of entrepreneurship - Traits of Entrepreneurs - Types of Entrepreneurs - Intrerpreneur - Difference between entrepreneur and intrepreneur - entrepreneurship in Economic growth - Factors affecting entrepreneurial growth, Major motives influencing entrepreneur-Case Studies: Few successful entrepreneurs in present time and their success stories.

Unit-2 **Teaching Hours:6**

BUSINESS

Business: Small Enterprises: - Definition Classification - Characteristics Web and e business - Ownership structure - Project formulation - Sources of information - Steps involved in setting up a business - Identifying, selecting a good business opportunity - Market survey and research - New business ideas-stages of growth and development in business-Case studies: Few successful businessmen in present time and their success stories.

Unit-3 **Teaching Hours:6**

FINANCING AND ACCOUNTING

Financing and Accounting: Sources of finance - Institutional Finance - Term loans - Capital structure - Management of working capital - Costing, Break even analysis - Taxation - Income Tax, Excise Duty - Sales Tax - Purchasing Policies and procedures - Methods of purchasing - Stores management - Book keeping.

Unit-4 **Teaching Hours:6**

MARKETING AND GROWTH STRATEGIES

Marketing & Growth Strategies: Principles of marketing - Assessment of market needs - Demand forecasting, Product life cycle - Sales promotion Strategies - Product mix - Advertising - Distribution Channels - Growth strategies - Expansion - Diversification - Joint venture, Merger - Sub-contracting.

Unit-5 **Teaching Hours:6**

INSTITUTIONAL SUPPORT TO ENTREPRENEURS

INSTITUTIONAL SUPPORT TO ENTREPRENEURS: Institutional support to entrepreneurs - Government policy for small-scale industries - Institutions for entrepreneurial growth - Various schemes - Self Help Group - Sickness in the industry - Causes - Steps for correction and rehabilitation.

Text Books And Reference Books:

Text Books:

T1. Entrepreneurship Development – Poornima. M. Charantimath, Small Business Enterprises Pearson Education - 2019.

T2. Entrepreneurship Development and Management, Sunil Gupta, ABD publishers, 2019.

Essential Reading / Recommended Reading

Reference Books:

R1. Dynamics of Entrepreneurial Development and Management, Vasant Desai, HPH 2018.

R2. Entrepreneurship in development and emerging economics, Ali J Ahmad, Punita Bhatt and Iain Acton, Sage Publications, 2019.

Evaluation Pattern

ASSESSMENT PATTERN FOR ENTREPRENEURSHIP DEVELOPMENT COURSE			
	Component	Assessed for	Scaled down to
1	CIA-1	20 M	05 M
2	CIA-2	50 M	10 M
3	CIA-3	20 M	05 M
4	Attendance	05 M	05 M
5	ESE	50 M	25 M
		TOTAL	50 M

ME436 - COMPUTER AIDED MACHINE DRAWING (2022 Batch)

Total Teaching Hours for Semester:45 **No of Lecture Hours/Week:4**

Max Marks:100 **Credits:3**

Course Objectives/Course Description

Machine Drawing is a language between the engineers, to communicate the technical information required for the manufacturing. This course deals with orthographic projection, fasteners, joints and couplings, and assembly drawings of machine parts. Review of basic sketching, parts, assembly and drawing commands in the software.

Course Outcome

CO1: Elaborate the concept and importance of limits fits and tolerance in the manufacturing drawing. (L2).

CO2: Summarize the thread terminologies, different types of fasteners, and keys used in machine parts. (L3)

CO3: Elaborate the concepts of rivets, riveted joints and different types of couplings used in industry. (L2)

CO4: Visualize and model the surface parts of a machine. (L2)

CO5: Ability to construct assembly drawing of various machines like crane hook, machine vice, tail stock of lathe, etc from the concepts learnt using the modeling software. (L5)

Unit-1 **Teaching Hours:8**

INTRODUCTION

Orthographic Views: Conversion of pictorial views into orthographic projections of Sectional views of machine parts. {Bureau of Indian Standards conventions are to be followed for the drawings} Hidden line conventions—precedence of lines.

Sections of solids: Sections and sectional views of right angular solids - Prism, Cylinder, Pyramid, Cone– Auxiliary Views.

Unit-2 **Teaching Hours:8**

THREADS AND FASTENERS

Thread Forms: Thread terminology, sectional views of threads. ISO Metric (Internal & External) BSW (Internal & External) square and Acme. Sellers thread, American Standard thread.

Fasteners: Hexagonal headed bolt and nut with washer (assembly), square headed bolt and nut with washer (assembly) simple assembly using stud bolts with nut and lock nut. Flanged nut, slotted nut, taper and split pin for locking, counter sunk head screw, grub screw, Allen screw.

Unit-3 **Teaching Hours:8**

RIVETED JOINTS AND COUPLINGS

Riveted joints: Single and double riveted lap joints, butt joints with single/double cover straps (Chain and Zigzag, using snap head rivets). cotter joint (socket and spigot), knuckle joint (pin joint) for two rods.

Couplings: Split Muff coupling, Protected type flanged coupling, pin (bush) type flexible coupling, Oldham's coupling and universal coupling (Hooks' Joint)

Unit-4 **Teaching Hours:8**

SURFACING

Surfacing: Introduction to surfacing, Hands on surface Modeling. Sheet Metal: Introduction to Sheet Metal, Modeling of sheet metal component.

Introduction to GD&T: Introduction to dimensional analysis, GD&T and its tools, Datum’s and concepts, manufacturing GD&T and its application, application of GD&T and its Principles.

Unit-5 **Teaching Hours:13**

ASSEMBLY DRAWINGS

Assembly Drawings

(Part drawings should be given)

1. Plummer block (Pedestal Bearing)

2. Rams Bottom Safety Valve

3. I.C. Engine connecting rod

4. Drill Jig

5. Tailstock of lathe

6. Machine vice

7. Crane Hook

Text Books And Reference Books:

T1. Machine Drawing by K L Narayana, P Kannaiah & K Venkata Reddy, 5th edition, New age International Publishers 2016.

T2. N.D.Bhat & V.M.Panchal,'A Primer on Computer Aided Machine Drawing-2007', VTU, Belgaum, 'Machine Drawing', 2012.

Essential Reading / Recommended Reading

R1. S. Trymbaka Murthy,' A Text Book of Computer-Aided Machine Drawing', CBS Publishers, New Delhi, 2007.

R2. K.R. Gopala Krishna, 'Machine Drawing', Subhash Publication, 2012.

R3. Goutam Pohit & Goutham Ghosh,' Machine Drawing with Auto CAD',1st Indian print Pearson Education, 2007.

R4. Auto CAD 2015, for engineers and designers', Sham Tickoo. Dream tech 2015.

R5. Machine Drawing', N. Siddeshwar, P. Kanniah, V.V.S. Sastri, published by Tata Mc McGraw-Hill,2006.

R6. Alex Krulikowski, "Fundamentals of Geometric Dimension & Tolerancing", 6th edition, Goodheart-Willcox Pub, 25 November 2014.

Evaluation Pattern

ASSESSMENT PATTERN FOR COMPUTER-AIDED MACHINE DRAWING COURSE			
	Component	Assessed for	Scaled-down to
1	CIA-1	20 M	10 M
2	CIA-2	50 M	25 M
3	CIA-3	20 M	10 M
4	Attendance	05 M	05 M
5	ESE	100 M	50 M
		TOTAL	100 M

ME451 - RENEWABLE ENEGRY LAB (2022 Batch)

Total Teaching Hours for Semester:30 **No of Lecture Hours/Week:2**

Max Marks:50 **Credits:1**

Course Objectives/Course Description

The purpose of this course is to impart the importance of the most important renewable energy resources, and the technologies for harnessing these energies. The potential of using renewable energy technologies as a replacement for conventional technologies is discussed. Strategies for enhancing the future use of renewable energy resources are presented.

Course Outcome

CO1: Experiment the working of a solar flat plate collector to calculate the overall heat loss coefficient, heat removal factor and efficiency. (L3)

CO2: Experiment the working of Parabolic Trough collector to calculate the overall heat loss co-efficient, heat removal factor and efficiency. (L3)

CO3: Analyze the performance of solar PV panels and wind training system through experimentation. (L4)

Unit-1 **Teaching Hours:30**

List of Experiments

List of Experiments	Practical Hours
1. Determination of Overall Heat Loss Co-efficient, Heat Removal Factor and Efficiency for Flat plate collector for FLATE PLATE COLLECTOR with thermosyphon mode of flow.	3
2. Determination of Overall Heat Loss Co-efficient, Heat Removal Factor and Efficiency for Flat plate collector for FLATE PLATE COLLECTOR with the forced mode of flow.	3
3. To determine the Performance of Overall Heat Loss Co-efficient, Heat Removal Factor and Efficiency of the Parabolic Trough collector with fixed parameters with water and oil as a working fluid.	3
4. To determine the Performance Overall Heat Loss Co-efficient, Heat Removal Factor and Efficiency of the Parabolic Trough collector with varying Solar Radiation with water and oil as working fluid	3
5. Evaluation of V-I characteristics of Solar PV- Module for series and parallel connection at a fixed angle and solar radiation.	3
6. Evaluation of V-I characteristics of Solar PV- Module for series and parallel connection at a different tilt angle.	3
7. Evaluation of V-I characteristics of Solar PV- Module for series and parallel connection at different tilt angle and solar radiation	3
8. Evaluation of Tip Speed Ratio (TSR) at different wind speeds	3
9. Evaluation of Coefficient of performance of wind turbine	3
10. Characteristics of turbine (power variation) with wind speed	3

Text Books And Reference Books:

Text Books:

T1. Rai.G.D, “Non-Conventional Energy Sources”, Khanna Publishers, 4th edition, New Delhi, 2011

T2. Domkundwar.V.M, Domkundwar.A.V, “Solar energy and Non-conventional sources of energy”, Dhanpat rai & Co. (P) Ltd, 1st edition, New Delhi, 2010

Essential Reading / Recommended Reading

Reference Books:

R1. “Solar Energy: Principles of Thermal Collection and Storage”, S P Sukhatme, Tata McGraw Hill, 2ND EDITION 15TH REPRINT 2006

R2. “Solar Engineering of Thermal processes”, J.A.Duffie and W.A.Beckman, John Wiley, New York, 4TH edition April 2013

R3. “Fuel Cells”, Bockris and Srinivasan; McGraw Hill

R4. Godfrey Boyle, “Renewable energy”, 2nd edition, Oxford University Press, 2010.

R5. Khan. B, “Non-conventional Sources of energy”, 2nd edition, New Delhi, Tata McGraw Hill, 2009.

R6. Tiwari. G.N, Ghosal. M.K, “Fundamentals of renewable energy sources”,1st edition, UK, Alpha Science International Ltd, 2007

R7.Twidell. J.W and Weir. A.D, “Renewable Energy Resources”, 2nd edition, UK, E & amp; F.N Spon Ltd.

Evaluation Pattern

ASSESSMENT PATTERN FOR PRACTICAL COURSES			
ONLY PRACTICAL			
	Component	Assessed for	Scaled-down to
1	CIA	50 M	25 M
2	ESE	50 M	25 M
		TOTAL	50 M

MICSAI432 - DATA STRUCTURES AND ALGORITHMS (2022 Batch)

Total Teaching Hours for Semester:75 **No of Lecture Hours/Week:5**

Max Marks:100 **Credits:4**

Course Objectives/Course Description

To understand the basic concept of data structures for storage and retrieval of ordered or unordered data. Data structures include: arrays, linked lists, binary

trees, heaps, and hash tables.

Course Outcome

CO1: Explain the basic concepts of data structures and solve the time complexity of the algorithm

CO2: Experiment with various operations on Linear Data structures

CO3: Examine the Structures and Operations of Trees and Heaps Data Structures

CO4: Compare various given sorting techniques with respect to time complexity

CO5: Choose various shortest path algorithms to determine the minimum spanning path for the given graphs

Unit-1 **Teaching Hours:8**

INTRODUCTION

Definition- Classification of data structures: primitive and non-primitive-

Operations on data structures- Algorithm Analysis

Unit-2 **Teaching Hours:11**

LISTS, STACKS AND QUEUES

Abstract Data Type (ADT) – The List ADT – The Stack ADT: Definition,

Array representation of stack, Operations on stack: Infix, prefix and postfix

notations Conversion of an arithmetic

Expression from Infix to postfix. Applications of stacks.

The Queue ADT: Definition, Array representation of queue, Types of queue:

Simple queue, circular queue, double ended queue (de-queue) priority

queue, operations on all types of Queues

Unit-3 **Teaching Hours:10**

TREES

Preliminaries – Binary Trees – The Search Tree ADT – Binary Search Trees –

AVL Trees – Tree Traversals – Hashing – General Idea – Hash Function –

Separate Chaining – Open Addressing –Linear Probing – Priority Queues

(Heaps) – Model – Simple implementations – Binary Heap

Unit-4 **Teaching Hours:8**

SORTING

Preliminaries – Insertion Sort – Shell sort – Heap sort – Merge sort –

Quicksort – External Sorting

Unit-5 **Teaching Hours:8**

GRAPHS

Definitions – Topological Sort – Shortest-Path Algorithms – Unweighted

Shortest Paths – Dijkstra's Algorithm – Minimum Spanning Tree – Prim's

Algorithm – Applications of Depth- First Search – Undirected Graphs –

Bi-connectivity – Introduction to NP-Completeness-case study

Text Books And Reference Books:

Mark Allen Weiss, "Data Structures and Algorithm Analysis in Java", 3rd Edition,

Pearson Education 2013.

Essential Reading / Recommended Reading

R1. Fundamentals of data structure in C by Ellis Horowitz, Sarataj Shani 3rd edition,

Galgotia book source PVT,2010.

R2.Classic Data Structures , Debasis Samanta ,2nd Edition, PHI Learning PVT,2011

Evaluation Pattern

CIA 1 20 MarKs

CIA 2 50 MarKs

CIA 3 20 MarKs

ESE 100 Marks

Total Teaching Hours for Semester:45 **No of Lecture Hours/Week:3**

Max Marks:100 **Credits:3**

Course Objectives/Course Description

Objective of this paper is to provide managing solid wastes. It is designed as a source of information on solid waste management, including the Principles of Solid waste management, Processing and Treatment, Final disposal, Recycle and Reuse.

Course Outcome

CO1: Identify characteristics and Functional elements of solid waste management (L2, L3)

CO2: Develop different methods of solid waste collection and transportation systems. (L2, L3)

CO3: Explain different solid waste treatment and processing techniques. (L2)

CO4: Explain sanitary landfill and different composting techniques. (L2)

CO5: Understand the different disposal methods, significance of recycling, reuse and reclamation of solid wastes. (L2)

Unit-1 **Teaching Hours:9**

Introduction

Definition, Land Pollution – scope and importance of solid waste management, functional elements of solid waste management

Unit-1 **Teaching Hours:9**

Sources

Classification and characteristics – municipal, commercial and industrial. Methods of quantification

Unit-2 **Teaching Hours:9**

Collection and Transportation

Systems of collection, collection equipment, garbage chutes, transfer stations – bailing and compacting, route optimization techniques and problems.

Unit-3 **Teaching Hours:9**

TREATMENT/PROCESSING TECHNIQUES

Components separation, volume reduction, size reduction, chemical reduction and biological processing problems.

Unit-3 **Teaching Hours:9**

INCINERATION

Process – 3 T's, factors affecting incineration process, incinerators – types, prevention of air pollution, pyrolsis, design criteria for incineration.

Unit-4 **Teaching Hours:9**

COMPOSTING

Aerobic and anaerobic composting, factors affecting composting, Indore and Bangalore processes, mechanical and semi mechanical composting processes. Vermi composting

Unit-4 **Teaching Hours:9**

SANITARY LAND FILLING

Different types, trench area, Ramp and pit method, site selection, basic steps involved, cell design, prevention of site pollution, leachate and gas collection and control methods, geo-synthetic fabricsin sanitary landfills.

Unit-5 **Teaching Hours:9**

RECYCLE AND REUSE

Material and energy recovery operations, reuse in other industries, plastic wastes, environmental significance and reuse.

Unit-5 **Teaching Hours:9**

DISPOSAL METHODS

Open dumping – selection of site, ocean disposal, feeding to hogs, incineration, pyrolsis, composting, sanitary land filling, merits and demerits, biomedical wastes and disposal

Text Books And Reference Books:

Bhide and Sunderashan "Solid Waste Management in developing countries",

Tchobanoglous "Integrated Solid Waste Management",Mc Graw Hill.

Essential Reading / Recommended Reading

Peavy and Tchobanoglous"Environmental Engineering",

Garg S K "Environmental Engineering", Vol II

"Biomedical waste handling rules – 2000".

Pavoni J.L. "Hand book on Solid Waste Disposal"

Evaluation Pattern

Sl No.	Evaluation Component	Module	Duration (min)	Nature of Component	Validation
1	CIA I	Quiz, assignment, & test	------	Closed Book/ Open book	Written test
2	CIA II	MSE	120	Closed Book	MSE
3	CIA III	Quiz, assignment,& test	-----	Closed Book/ Open book	Written test
4	Semester Exam	ESE	180	Closed Book	ESE

CEOE532 - DISASTER MANAGEMENT (2021 Batch)

Total Teaching Hours for Semester:45 **No of Lecture Hours/Week:3**

Max Marks:100 **Credits:3**

Course Objectives/Course Description

Course would help to understand the scope and relevance of Multi Disciplinary approach in Disaster Management in a dynamic world and to realize the responsibilities of individuals and institutions for effective disaster response and disaster risk reduction

Course Outcome

CO-1: Explain Hazards and Disasters (L2, PO 4)

CO-2: Assess managerial aspects of Disaster Management, plan and explain risk analysis (L3, PO5)

CO-3: Relate Disasters and Development (L4, PO7)

CO-4: Compare climate change impacts and develop scenarios (L5, PO6)

CO-5: Categorize policies and institutional mechanisms in Disaster Management and the impacts on society (L5, PO7)

Unit-1 **Teaching Hours:8**

Introduction to Hazard and Disasters

Principles of Disaster Management, Hazards, Risks and Vulnerabilities; Natural Disasters (Indicative list: Earthquake, Floods, Fire, Landslides, Tornado, Cyclones, Tsunamis, Human Induced Disasters (e.g Nuclear, Chemical, Terrorism. Assessment of Disaster Vulnerability of a location and vulnerable groups; Pandemics

Unit-2 **Teaching Hours:8**

Disaster Management Cycle and Humanitarian Logistics

Prevention, Preparedness and Mitigation measures for various Disasters, Post Disaster Relief & Logistics Management, Emergency Support Functions and their coordination mechanism, Resource & Material Management, Management of Relief Camp, Information systems & decision making tools, Voluntary Agencies & Community Participation at various stages of disaster, management.

Unit-3 **Teaching Hours:8**

Natural resources and Energy sources

Renewable and non-renewable resources, Role of individual in conservation of natural resources for sustainable life styles. Use and over exploitation of Forest resources. Use and over exploitation of surface and ground water resources, Conflicts over water, Dams- benefits and problems.

Unit-4 **Teaching Hours:10**

Global Environmental Issues

Global Environmental crisis, Current global environment issues, Global Warming, Greenhouse Effect, role of Carbon Dioxide and Methane, Ozone Problem, CFC"s and Alternatives, Causes of Climate Change Energy Use: past, present and future, Role of Engineers.

Unit-5 **Teaching Hours:11**

Disaster Risk Reduction and Development

Disaster Risk Reduction and Institutional Mechanisms Meteorological observatory – Seismological observatory - Volcanology institution - Hydrology Laboratory; National Disaster Management Authority (India); Disaster Policies of Foreign countries.

Integration of public policy: Incident Command System; National Disaster Management Plans and Policies; Planning and design of infrastructure for disaster management, Community based approach in disaster management, methods for effective dissemination of information, ecological and sustainable development models for disaster management.

Technical Tolls for Disaster Management: Monitoring, Management program for disaster mitigation ; Geographical Information System(GIS) ; Role of Social Media in Disaster Management

Text Books And Reference Books:

T1. Paul, B.K, "*Environmental Hazards and Disasters: Contexts, Perspectives and Management*", Wiley-Blackwell, 2011. (Unit 1 – Chapter 1; Unit 2 – Chapter 1, 3; Unit 3 – Chapter 4; Unit 4 – Chapter 5 & 6)

T2. Keller, Edward, and Duane DeVecchio. "*Natural hazards: earth's processes as hazards, disasters, and catastrophe"s*. Pearson Higher Education AU, 2015. (Unit 5 – Chapter 6 & 7)

Essential Reading / Recommended Reading

R1. Coppola, D, "*Introduction to International Disaster Management* "Elsevier, 2015.

R2. Fookes, Peter G., E. Mark Lee, and James S. Griffiths. "Engineering geomorphology: theory and practice." Whittles Publications, 2007.

R3. Tomasini, R. And Wassanhove, L.V (2009). Humanitarian Logistics. Pangrave Macmillan.

Evaluation Pattern

Ser No	Evaluation Component	Module	Duration (Mins)	Nature Of Component	Weightage Of Module	Validation
1	CIA I	Assignment Quizes		Open Book	Assignment 50% Quiz 30% Class participation 20% 100%	
2	CIA II	MSE	120	CLOSED BOOK		
3	CIA III	Assignment		Research Oriented		
4	SEMESTER EXAM	ESE	180	CLOSED BOOK		Written Test

CH536OE1 - ELECTRONIC MATERIALS AND ITS FABRICATION (2021 Batch)

Total Teaching Hours for Semester:45 **No of Lecture Hours/Week:3**

Max Marks:50 **Credits:3**

Course Objectives/Course Description

1) Discuss the students on advanced concepts of Electrical Conduction, Modern Theory of Solids, and fundamental properties of Semiconductors.

i) Students will learn (a) the principle, construction, and operation of basic Semiconductor Devices such as Light Emitting Diodes (LEDs), Solar Cells, and transistors.

ii) It describes the opportunities to learn (a) advanced concepts governing electronic materials properties of inorganic conductors, semiconductors and insulators and (b) how these electronic materials can be combined in wide range of device applications from transistors to energy conversion.

iii) To illustrate the current state-of-the-art by reference to journal articles and to examples of actual devices and production processes in use today.

Course Outcome

CO1: Explain the fundamentals of quantum mechanics to learn the construction and working of electronic devices.

CO2: Outline the relevant points pertaining to electrical and thermal conduction in solids

CO3: Outline the fundamentals and advanced concepts of semiconductors and other related terms which are indispensable to fabricate electronic devices.

CO4: Explain the materials aspects and fabrication procedures of semiconducting materials

CO5: Analyze the semiconductor characteristics and materials aspects to design and develop electronic devices

Unit-1 **Teaching Hours:5**

Basic concepts of quantum mechanics:

Differences between classical and quantum mechanics, Postulates of quantum mechanics and the concept of wave function, Details of wave particle duality, Schrodinger equation

Unit-2 **Teaching Hours:10**

Electrical and Thermal conductivity in solids

Elementary Concepts and Electrical Conduction, Electrical and thermal conductivity in solids ;Classical theory: The Drude model (Dependance of

current density, drift velocity and electric field), Temperature dependance of resistivity, Hall effect and Hall devices, Thermal conductivity in solids

(Fourier, s law and Weidemann-Franz-Lorenz law) , Thin films and sheet resistance, Polycrystalline films and Grain boundary scattering (Mayadas-

Shatzkes Formula), Density of states and maximum probable distributions, Fermi Dirac and Maxwell-boltzmann distribution laws.

Unit-3 **Teaching Hours:10**

Semiconductors:

Basics of semiconductors, Intrinsic and Extrinsic semiconductors, Band diagram at absolute zero, Relationship between conductivity and drift mobilities, Degenerate and non-degenerate semiconductors, Recombination of carriers (Direct and indirect) and minority carrier injection, Density of states in semiconductors, Determination of elctron and hole concentrations (Fermi level), Schottky Junctions and Ohmic Contacts.

Unit-4 **Teaching Hours:10**

Semiconductor manufacturing and film deposition techniques:

Overview of semiconductor manufacturing and silicon wafer production, Thin films depositions, Diffusion and ion implantation, Oxidation, Plasma processing Lithography, Spray pyrolysis and Spin coating.

Unit-5 **Teaching Hours:10**

Semiconductor based devices:

Basics of p-n junction (Calculation of barrier potential, depletion width and electric filed), Band diagram of p-n junction, Band digram under forward and reverse bias conditions, Law of the junction, Light Emitting Diodes (LEDs), Photovoltaics, Bipolar and Metal-Oxide-Semiconductor Field Effect Transistors (MOSFET), Transparent Conducting electrodes.

Text Books And Reference Books:

R1. Principles of Electronic Materials and Devices , Third Edition by S.O.Kasap, ISBN: 0-07-295791-3

R2. Electronic Properties of Materials, by Rolf E. Hummel (3 rd Edition, Springer, New York, 2000)

R3. Microchip Manufacturing, by S. Wolf, ISBN: 0-9616721-8-8

Essential Reading / Recommended Reading

R1. Electronic Materials and Devices, David K. Ferry and Jonathan Bird, Academic Press, San Diego, 2001.

R2. Advanced Semiconductor Fundamentals (2 nd Edition), Robert F. Pierret, Prentice Hall, 2003.

Evaluation Pattern

Sl No	CIA Component	Unit(s) Covered	CO	RBT Level
1	CIA1 Closed Book Test	1,2	CO-1,CO-2	L2
2	CIA 2(MID SEMESTER EXAMINATION)	1,2 & 1/2 of Unit 3	CO-1,2,3	L2
3	CIA3 Assignment	4,5	CO-4,5	L2, L4

CIA 1 COMPONENT 1 – CLOSED BOOK TEST

 A closed book descriptive test will be conducted after completion of Unit 1 and unit 2

 Question paper contains four theory questions and each carries 5 marks

 Maximum Marks : 20

 Time : 45 Minutes

 Tentative date :

 Venue :Theory Classrooms/LMS Upload(Students can upload the answers in LMS/ Google Classroom)

Marks Distribution Theory Questions

 Definition – 1 marks

 Principle – 2 marks

 Explanation with all relevant point (chemical equation, formulas diagrams graphs)- 2 marks

Marks Distribution Numerical Questions

 Equation with explanation for notations – 1.5 marks

 Substitution of values in the required formula– 0.5 marks

 Problem solving with final answer – 2 marks

 Unit for final value- 1 marks

CIA 3 COMPONENT 1 – Assignment

 Assignment will be given based on 4 th and 5 th units.

 Students will be asked to submit the assignment multiple times to get better clarity on the

electronic materials and device fabrications concepts.

 The marks will be warded based on the content, conceptual clarity and way of presentation of

the contents.

 Maximum Marks : 20

 Venue : LMS Upload(Students can upload the assignment in LMS/ Google Classroom)

HS522 - PROJECT MANAGEMENT AND FINANCE (2021 Batch)

Total Teaching Hours for Semester:30 **No of Lecture Hours/Week:2**

Max Marks:50 **Credits:2**

Course Objectives/Course Description

- Tounderstandtheconceptsofprojectdefinition,lifecycle,andsystems approach
- Todevelopcompetencyinprojectscooping,workdefinition,andwork breakdown structure {WBS}
- Exploretheentrepreneurialmind-setandculturethathasbeendeveloping in companies of all sizes and industries.
- Examine the entrepreneurial process from the generation of creative ideastoexploringfeasibility tocreationofanenterpriseforimplementationofthe

ideas.

Course Outcome

Unit-1 **Teaching Hours:6**

Introduction to Project Management

IntroductiontoOrganisations,PrinciplesofManagement-itsfunctions, Skills, Organisation Structure, Financial Feasibility. Introduction to Project,Concept,ProjectManagement,ProjectLifeCycle,RoleofProject Manager-FunctionalAreas,QualitiesandResponsibiities,Impactof

DelaysinProjectCompletions

Unit-2 **Teaching Hours:6**

Project Planning

Project management functions - Controlling, directing, project authority, responsibility, accountability, Scope of Planning, Market Analysis, Demand Forecasting, Product line analysis, Product Mix Analysis, New Product development, Plant location,plant capasity, Capital Budgeting,Time Value of Money,Cash flow importance,

decisiontree analysis

Unit-3 **Teaching Hours:6**

Project Scheduling

Introduction,Estimation of Time, Project NetworkAnalysis- CPMand PERT model, Gantt Chart, Resource Loading,Resource Leveling, Resource Allocation.Estimating activity time and total program time, totalPERT/CPMplanningcrashtimes,software'susedinproject

management

Unit-4 **Teaching Hours:6**

Project Monitoring and Controlling

Introduction, Purpose, Types of control, Designing and Monitoring Systems, reporting and types. Financial Control, Quality Control, HumanResourceControl,ManagementControlSystem,ProjectQuality Management, Managing Risks.

Unit-5 **Teaching Hours:6**

Project Evaluation and Auditing

TypesofProjectClosures,Wrap-Upclosureactivities,PurposeofProject Evaluation - Advantages, factors considered for termination of project, Project Termination process, Project Final report. Bidgeting, Cost estimation, cost escalation, life cycle cost. Project finance in the roads sector,Projectfinance(BuildOwnOperate(BOO)/BuildOwnOperate

Transfer (BOOT)Projects/BuildOperate andTransfer (BOT)

Text Books And Reference Books:

R1. P C Tripathi and P N Reddy, "Principles of Management", Tata McGraw-Hill Education, 2012

R2. R. Panneerselvam and P. Senthil Kumar "Project Management" PHI learningIndia PVT Ltd

R3.Bhavesh.MPatel,"ProjectManagement"VikasPublishingHousPVTLtd

R4. Prasanna Chandra "Projects, Planning, analysis, selection financing,

Implementationand Review" Tata McGraw Hill Co

Essential Reading / Recommended Reading

T1.Project Management,Dr.SanjeevMarwah

T2. Project Management for Business Ethics, Engineering and Technology, John M Nicholas, Herman Steyn

T3.PK.Joy"TotalProjectManagementtheIndiancontext",MacMilanIndiaLt

Evaluation Pattern

THEORY				
Component	**Assessed for**	**Scaled down to**	**Min. marks to pass**	**Max. marks**
CIA-1	20	**10**	-	**10**
CIA-2	50	**25**	-	**25**
CIA-3	20	**10**	-	**10**
Attendance	05	**05**	-	**05**
ESE	100	**50**	20	**50**
	TOTAL	**100**	-	**100**

IC521 - INDIAN CONSTITUTION (2021 Batch)

Total Teaching Hours for Semester:30 **No of Lecture Hours/Week:2**

Max Marks:50 **Credits:0**

Course Objectives/Course Description

This course is aimed to create awareness on the rights and responsibilities as a citizen of India and to understand the administrative structure, legal system in India.

Course Outcome

CO1: Explain the fundamental rights granted to citizens of India as per the Constitution

CO2: Describe the Directive Principles of State Policy along with its key aspects

CO3: Explain the legislative powers of Union Government and its elected legislature

CO4: Understand the Indian judiciary with respect to civil and criminal aspects

CO5: Explain the working of state government and its electoral powers

Unit-1 **Teaching Hours:6**

Making of the Constitution and Fundamental Rights

Introduction to the constitution of India, the preamble of the constitution, Justice, Liberty, equality, Fraternity, basic postulates of the preamble

Right to equality, Right to freedom, Right against exploitation, Right to freedom of religion, Cultural and educational rights, Right to constitutional remedies

Unit-2 **Teaching Hours:6**

Directive Principles of State Policy and Fundamental Duties

Directive Principles of State Policy, key aspects envisaged through the directive principles, Article 51A and main duties of a citizen in India

Unit-3 **Teaching Hours:6**

Union Government and Union Legislature

the president of India, the vice president of India, election method, term, removal, executive and legislative powers, prime minister and council of ministers, election, powers, parliament, the Upper House and the Lower House, composition, function

Unit-4 **Teaching Hours:6**

Indian Judiciary

Supreme court, high courts, hierarchy, jurisdiction, civil and criminal cases, judicial activism

Unit-5 **Teaching Hours:6**

State Government and Elections in India

State executive, governor, powers , legislative council and assembly, composition, powers, electoral process, election commission, emergency

Text Books And Reference Books:

R1. B R Ambedkar, 'The Constitution of India'. Government of India

R2. Durga Das Basu, Introduction to the Constitution of India, LexisNexis, 24th edition

Essential Reading / Recommended Reading

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Evaluation Pattern

As per university norms

MA536OE6 - APPLIED STATISTICS (2021 Batch)

Total Teaching Hours for Semester:30 **No of Lecture Hours/Week:3**

Max Marks:50 **Credits:2**

Course Objectives/Course Description

To enable the students to describe the fundamentals of statistics, estimate best fit curve, correlation and regression through data analysis, develop a deep understanding of axioms, random variables and probability functions, test the hypothesis for small and large samples by various statistical tools.

Course Outcome

CO1: Determine the mean, median, mode and expectation by using the fundamentals of statistics {L3}

CO2: Estimate the best fit curve, correlation and regression through data analysis {L2}

CO3: Determine the probability density function of discrete and continuous random variables by applying the key concepts of probability. {L3}

CO4: Calculate the mean, variance and probability density function of different theoretical distributions {L3}

CO5: Test the hypothesis of small and large samples using various statistical tools {L5}

Unit-1 **Teaching Hours:6**

Probability

Fundamentals of Statistics, Mean, median, mode, expectation.

Unit-2 **Teaching Hours:6**

Curve Fitting

Curve fitting by the method of least squares, $y = a + bx$, $y = a + bx + cx^2$, $y = ax^b$, $y = ab^x$, $y = ae^x$,

Correlation and Regression

Unit-3 **Teaching Hours:6**

Random Variable

Basic probability theory along with examples, Random variables – Discrete

and continuous random variables. Probability mass function (pmf), Probability

density function (pdf), cumulative distribution function (cdf), mean, variance

Unit-4 **Teaching Hours:6**

Sampling

Theoretical distribution - Binomial, Poisson, Normal and Exponential distributions

Unit-5 **Teaching Hours:6**

Testing Tools

Testing of hypothesis, small and large samples, student t – test, F – test, chi – square test, testing by statistical tools

Text Books And Reference Books:

T1. Ross, S., "A first course in probability", 9th Edition, Pearson Education, Delhi, 2012.

T2. T.Veerarajan, "Probability, Statistics and Random process", 3rd Edition, Tata McGraw Hill, New Delhi, 2008.

Essential Reading / Recommended Reading

R1. Allen., A.O., "Probability, Statistics and Queuing Theory", Academic press, New Delhi, 1981.

Evaluation Pattern

CIA1(COMPONENT-1)	**Closed book Test: Unit 2 (CO2), Assignment**
CIA1(COMPONENT-2)	**Closed book Test: Unit 1 (CO1)**
CIA2(Mid Semester Examination)	**Closed book Test: Unit 1, Unit 2 and Unit 3 (CO1, CO2, CO3)**
CIA3(COMPONENT-1)	**Closed book Test: Unit 4 (CO5)**
CIA3(COMPONENT-2)	**Closed book Test: Unit 5 (CO5)**

End Semester Examination

ME531 - KINEMATICS AND THEORY OF MACHINES (2021 Batch)

Total Teaching Hours for Semester:45 **No of Lecture Hours/Week:3**

Max Marks:100 **Credits:3**

Course Objectives/Course Description

1. To understand the kinematics and rigid-body dynamics of kinematically driven machine components.

2. To understand the motion of linked mechanisms in terms of the displacement, velocity and acceleration at any point in a rigid link.

3. To be able to design some linkage mechanisms and cam systems to generate specified output motion.

4. To understand the kinematics of gear trains.

Course Outcome

CO1: Summarize the fundamentals of kinematics and Planar mechanisms.

CO2: Analyse velocity and acceleration parameters in various four-bar mechanisms using the instantaneous centre method and relative velocity method.

CO3: Develop the displacement diagram for a required output and design cam profiles for inline and offset followers.

CO4: Explain the fundamentals of gear profiles and extrapolate various parameters of Spur gear teeth.

CO5: Design gear trains for power transmission.

Unit-1 **Teaching Hours:9**

Classification of mechanisms

Classification of mechanisms- Basic kinematic concepts and definitions- Degree of freedom, mobility- Grashoff's law, Kinematic inversions of four bar chain and slider crank chains-Limit positions- Mechanical advantage- Transmission angle- Description of some common mechanisms- Quick return mechanism, straight line generators- Universal Joint- Rocker mechanisms

Unit-2 **Teaching Hours:9**

Velocity and acceleration

Displacement, velocity and acceleration analysis of simple mechanisms, graphical velocity analysis using instantaneous centers, velocity and acceleration analysis using loop closure equations- kinematic analysis of simple mechanisms- slider crank mechanism dynamics- Coincident points- Coriolis component of acceleration- introduction to linkage synthesis-three position graphical synthesis for motion and path generation

Unit-3 **Teaching Hours:9**

CAMS

Classification of cams and followers- Terminology and definitions- Displacement diagrams-Uniform velocity, parabolic, simple harmonic and cycloidal motions- derivatives of follower motions- specified contour cams- circular and tangent cams- pressure angle and undercutting, sizing of cams, graphical and analytical disc cam profile synthesis for roller and flat face followers

Unit-4 **Teaching Hours:9**

Gears

Involute and cycloidal gear profiles, gear parameters, fundamental law of gearing and conjugate action, spur gear contact ratio and interference/undercutting- helical, bevel, worm, rack & pinion gears, epicyclic and regular gear train kinematics

Unit-5 **Teaching Hours:9**

Friction

Surface contacts- sliding and rolling friction- friction drives- bearings and lubrication-friction clutches- belt and rope drives- friction in brakes

Text Books And Reference Books:

T1. Ghosh A. and Mallick A.K., Theory of Mechanisms and Machines, Affiliated East-West Pvt. Ltd, New Delhi, 1988.

T2. Ratan.S.S, “Theory of Machines”, 4th Edition, Tata McGraw Hill Publishing company Ltd. 2014.

Essential Reading / Recommended Reading

R1. Thomas Bevan, Theory of Machines, 3rd edition, CBS Publishers & Distributors, 2005.

R2. CleghornW.L. , Mechanisms of Machines, Oxford University Press, 2005.

R3. Robert L. Norton, Kinematics and Dynamics of Machinery, Tata McGrawHill, 2009.

Online Resources

W1. https://nptel.ac.in/courses/112104121/

Evaluation Pattern

ASSESSMENT PATTERN FOR THEORY COURSE			
	Component	Assessed for	Scaled-down to
1	CIA-1	20 M	10 M
2	CIA-2	50 M	25 M
3	CIA-3	20 M	10 M
4	Attendance	05 M	05 M
5	ESE	100 M	50 M
		TOTAL	100 M

ME532 - DESIGN OF MACHINE ELEMENTS (2021 Batch)

Total Teaching Hours for Semester:45 **No of Lecture Hours/Week:3**

Max Marks:100 **Credits:3**

Course Objectives/Course Description

1.To facilitate the students to appreciate and understand the design function in mechanical engineering, the steps involved in designing and the relation of design activity with manufacturing activity.

2.To choose proper materials to different machine elements depending on their physical and mechanical properties. Thus he shall be able to apply the knowledge of material science in real life usage.

3.To gain a thorough understanding of the different types of failure modes and criteria. He will be conversant with various failure theories and be able to judge which criterion is to be applied in which situation.

4.To design different types of elements used in the machine design process. Ex. Curved beams, cylinders, springs, Riveted and welded joints etc. and will be able to design these elements for each application.

Course Outcome

CO1: Discuss the various steps involved in designing, the relation of design activity with manufacturing activity and demonstrate the use standard practices in design. {L2}

CO2: Identify the different types of failure modes which will be conversant with various failure theories and judge the appropriate criterion for different situation. {L3}

CO3: Apply the knowledge of the curved beams and cylinders in determining the stresses developed for its real time usage. {L3}

CO4: Select the type of spring required for the application and calculate the dimensions of spring. {L3}

CO5: Design the different types of elements used in the machine design process. Eg. Riveted joint, Welded Joints etc. {L4}

Unit-1 **Teaching Hours:9**

Definitions

Normal, shear, biaxial and tri axial stresses, Stress tensor, Principal Stresses. Engineering Materials and their mechanical properties, Stress-Strain diagrams, Stress Analysis, Design considerations: Codes and Standards.

Unit-1 **Teaching Hours:9**

Static Strength

Static loads and factor of safety, Theories of failure: Maximum normal stress theory, Maximum shear stress theory, Maximum strain theory, Strain energy theory, Distortion energy theory. Failure of brittle and ductile materials, Stress concentration, Determination of Stress concentration factor.

Unit-2 **Teaching Hours:9**

Impact Strength

Introduction, Impact stresses due to axial, bending and torsional loads, effect of inertia.

Unit-2 **Teaching Hours:9**

Design For Fatigue Strength

Introduction- S-N Diagram, Low cycle fatigue, High cycle fatigue, Endurance limit, Modifying factors: size effect, surface effect, Stress concentration effects, Fluctuating stresses, Goodman and Soderberg relationship, stresses due to combined loading, cumulative fatigue damage.

Unit-3 **Teaching Hours:9**

Cylinders & Cylinder Heads

Review of Lame's Equations; compound cylinders, stresses due to different types of fits, cylinder heads, flats.

Unit-3 **Teaching Hours:9**

Curved Beams

Stresses in curved beams of standard cross sections used in crane hook, punching presses & clamps, closed rings and links

Unit-4 **Teaching Hours:9**

Design Of Springs

Types of springs - stresses in Helical coil springs of circular and non-circular cross sections. Tension and compression springs, springs under fluctuating loads, Leaf Springs: Stresses in leaf springs. Equalized stresses, Energy stored in springs, Torsion, Belleville and Rubber springs.

Unit-5 **Teaching Hours:9**

Riveted and Welded Joints

Types, rivet materials, failures of riveted joints, Joint Efficiency, Boiler Joints, Lozanze Joints, Riveted Brackets. Welded Joints – Types, Strength of butt and fillet welds, eccentrically loaded welded joints.

Unit-5 **Teaching Hours:9**

Threaded Fasteners:

Stresses in threaded fasteners, Effect of initial tension, Design of threaded fasteners under static, dynamic and impact loads, Design of eccentrically loaded bolted joints.

Text Books And Reference Books:

T1. Design of Machine Elements 1, K Raghavendra, CBS Publishers and Distributors Private Limited, New Delhi, 1nd Edition 2017.

T2. Design of Machine Elements 2, K Raghavendra, CBS Publishers and Distributors Private Limited, New Delhi, 1nd Edition 2015.

T3. Mechanical Engineering Design, Joseph E Shigley and Charles R. Mischke, McGraw Hill International edition, 6th Edition 2009.

T4. Design of Machine Elements, V.B. Bhandari, Tata McGraw Hill Publishing Company Ltd., New Delhi, 3rd Edition first reprint 2010.

Essential Reading / Recommended Reading

R1. Robert L. Norton, “Machine Design”, 3rd Impression, Pearson Education Asia, 2008.

R2. M. F. Spotts, T. E. Shoup, L. E. Hornberger, S. R. Jayram and C. V. Venkatesh, “Design of Machine Elements”, Special Indian Edition, Pearson Education, 2006.

R3. Hall, Holowenko, Laughlin, “Machine Design”, Special Indian Edition, Schaum’s Outlines series, Tata McGraw Hill Publishing Company Ltd., 2010.

R4. Robert C. Juvinall and Kurt M Marshek, “Fundamentals of Machine Component Design”, 5th Edition, Wiley India Pvt. Ltd., 2012.

DESIGN DATA HANDBOOKS:

1. K. Lingaiah, “Design Data Hand Book”, 4th edition, McGraw Hill, 2013.

2. K. Mahadevan and Balaveera Reddy, “Design Data Hand Book”, 4th edition, CBS Publication, 2013.

3. H.G. Patil, Shri Shashi Prakashan, “Design Data Hand Book”, Belgaum. Reprint, I K International Publishing house, 2011.

Online Resources:

W1. https://nptel.ac.in/downloads/112105125/

W2. https://nptel.ac.in/syllabus/112106137/

Evaluation Pattern

ASSESSMENT PATTERN FOR THEORY COURSE			
	Component	Assessed for	Scaled down to
1	CIA-1	20	10
2	CIA-2	50	25
3	CIA-3	20	10
4	Attendance	05	05
5	ESE	100	50
		TOTAL	100

ME533P - INTERNAL COMBUSTION ENGINES (2021 Batch)

Total Teaching Hours for Semester:60 **No of Lecture Hours/Week:4**

Max Marks:100 **Credits:3**

Course Objectives/Course Description

Course objectives:

- To make students familiar with the design and operating characteristics of modern internal combustion engines
- To apply analytical techniques to the engineering problems and performance analysis of internal combustion engines
- To study the thermodynamics, combustion, heat transfer, friction and other factors affecting engine power, efficiency and emissions
- To introduce students to the environmental and fuel economy challenges facing the internal combustion engine
- To introduce students to future internal combustion engine technology and market trends

Course Outcome

CO1: Discuss the construction, operation, and combustion process in IC engines. [L2]

CO2: Illustrate the construction and working of ignition and fuel injection system, and combustion chamber designs for SI and CI engines. [L2]

CO3: Explain the availability of alternative fuels for IC engines and influence of their properties on performance of the IC engines. [L2]

CO4: Demonstrate the effects of engine operating variables on IC engines performance and knock formation. [L3]

CO5: Differentiate and determine the efficiencies of IC engine thermodynamic cycles. [L4]

CO6: Interpret the methods to arrive properties of fuel samples, performance parameters and heat balance sheet of IC engines using dynamometers and calorimeter. [L3]

Unit-1 **Teaching Hours:5**

Basic Concepts of Engines

Basics of IC Engines: Heat Engine, IC And EC Engines, IC Engine Construction, Applications, Engine Nomenclature, Engine Classification, 2 And 4 Stroke Operations, Valve and Port Timing Diagram.

Unit-2 **Teaching Hours:7**

IC Engine Cycles

Fuel Air Cycle and Actual Cycle: Fuel Air Cycle, Assumptions, Comparison with Air Standard Cycle, Carnot Cycle and Efficiency, Actual Cycle, Studyof Otto Cycle, Diesel Cycle, Dual Cycle-Equations For Efficiency, Mean Effective Pressure.

Unit-3 **Teaching Hours:6**

SI Engines

Combustion in SI Engine: Flame Speed, Ignition Delay, Abnormal Combustion and its Control, Combustion Chamber Design for SI Engines, Mixture Requirements.

Ignition System: Requirements, Magneto and Battery Ignition Systems, Electronic Ignition, Ignition Timing.

Unit-4 **Teaching Hours:6**

CI Engines

Combustion in CI Engines: Ignition Delay, Knock and its Control, Comparison of SI and CI Engine Combustion, Combustion Chamber Design for CI Engines,

Fuel Injection in CI Engines: Requirements, Types of Injection Systems, Fuel Pumps.

Unit-5 **Teaching Hours:6**

Fuels for SI and CI Engine

Fuels for SI and CI Engine: Important Qualities of SI Engine Fuels, Rating of SI Engine Fuels, Important Qualities of CI Engine Fuels, Dopes, Additives, Gaseous Fuels-LPG, CNG, Biogas, Producer Gas.

Text Books And Reference Books:

Text Books:

1. Heywood, John B, “Internal Combustion Engine Fundamentals”, McGraw-Hill, 2007.
2. V Ganesan, “Internal Combustion Engines”, 4th edition, Tata McGraw-Hill publishing-company Limited, 2012.
3. Mathur & Sharma, “A Course in International Combustion Engines”, 8th edition, Dhanpat Rai & Sons., 1996.
4. Colin R. Ferguson, Allen T Kirkpatrick, “Internal Combustion Engines”, 3rd edition, John Wiley & sons, 2016.

Essential Reading / Recommended Reading

Reference Books:

1. Edward. F. Obert, “I.C. Engines”, Harper International edition, 1973.
2. V Ganesan, “Internal Combustion Engines”, 4th edition, Tata McGraw-Hill publishing company Limited, 2012.
3. Willard W. Pulkrabek, “Engineering Fundamentals of the I.C. Engine”, 2nd edition, 2013.
4. Lichty, “Combustion Engine Process”, 6th edition, Judge, 2000.

Online Resources:

1. https://nptel.ac.in/courses/103105110/40
2. https://nptel.ac.in/courses/103105110/32
3. https://nptel.ac.in/courses/112/104/112104033/

Evaluation Pattern

COURSES WITH THEORY AND PRACTICAL				
	Component	**Assessed for**	**Minimum marks to pass**	**Maximum marks**
1	Theory CIA	30	-	30
2	Theory ESE	30	12	30
3	Practical CIA	35	14	35
4	Attendance	05	-	05
5	Aggregate	100	40	100

Total Teaching Hours for Semester:45 **No of Lecture Hours/Week:3**

Max Marks:100 **Credits:3**

Course Objectives/Course Description

The course discusses the use of solar {thermal and photovoltaic}, hydro-electric, wind, geothermal, ocean thermal, wave, tidal and geothermal energy, as well as energy from biomass. The use of fuel-cell systems is dealt with. Issues relevant to energy efficiency and energy storage are discussed. The potential of using renewable energy technologies as a replacement for conventional technologies are discussed.

Course Outcome

CO1: To classify and compare the various solar thermal systems like: Solar thermal collectors, flat plate collectors, concentrating collectors, Basic theory of flat plate collectors, solar heating of buildings, solar still, solar water heaters, solar driers and solar photovoltaic applications: battery charger, domestic lighting, street lighting, water pumping, power generation schemes. {L2} {PO1, PO2, PO6, PO7, PO9,PO12}

CO2: To examine the working of wind, Tidal and wave energy with respect to their types, advantages and disadvantages. {L3} {PO1, PO2, PO3, PO6, PO7, PO9, PO12}

CO3: To describe the concept of thermoelectric system and classify the various biomass and biofuels for Thermo-chemical conversion, direct combustion, biomass gasification, pyrolysis and liquefaction, biochemical conversion and anaerobic digestion. {L3} {PO1, PO6, PO7}

CO4: To classify and apply the concept of vapour dominated and liquid dominated system in geothermal energy. To describe the MHD open and closed systems. {L2} {PO1, PO6, PO7}

CO5: To classify and compare the acidic and alkaline hydrogen-oxygen fuel cells, and to explain the Hydrogen production, storage and utilization.. {L3} {PO1, PO6, PO7}

Unit-1 **Teaching Hours:9**

Solar Energy and Solar Photovoltaic

Solar Energy: Global and National scenarios, Form and characteristics of renewable energy sources, Solar radiation, its measurements and prediction, Solar thermal collectors, flat plate collectors, concentrating collectors, Basic theory of flat plate collectors, solar heating of buildings, solar still, solar water heaters, solar driers; conversion of heat energy into mechanical energy, solar thermal power generation systems

Solar Photovoltaic: Principle of photovoltaic conversion of solar energy, types of solar cells and fabrication. Photovoltaic applications: battery charger, domestic lighting, street lighting, water pumping, power generation schemes

Unit-2 **Teaching Hours:9**

Wind Energy and Tidal and Wave Energy

Wind Energy: Atmospheric circulations, classification, factors influencing wind, wind shear, turbulence, wind speed monitoring, Betz limit, WECS: classification, characteristic, applications

Tidal and Wave Energy: Energy from tides, basic principle of tidal power, single basin and double basin tidal power plants, advantages, limitation and scope of tidal energy. Wave energy and power from wave, wave energy conversion devices, advantages and disadvantages of wave energy.

Unit-3 **Teaching Hours:9**

Thermoelectric Systems and Biomass

Thermoelectric Systems: Kelvin relations, power generation, Properties of thermoelectric materials, Fusion Plasma generators

Biomass and Biofuels: Biomass resources and their classification, Biomass conversion processes, Thermo-chemical conversion, direct combustion, biomass gasification, pyrolysis and liquefaction, biochemical conversion, anaerobic digestion, types of biogas Plants, applications, alcohol production from biomass, bio diesel production, Urban waste to energy conversion-Biomass energy program in India

Unit-4 **Teaching Hours:9**

Geothermal Energy and MHD

Geothermal Energy: Introduction, classification of geothermal systems vapour dominated, liquid dominated system, total flow concept, petrothermal systems, magma resources, applications of geothermal operational & environmental problems

Magneto Hydro Dynamic Power Generation: Introduction principles of MHD power generation, MHD open and closed systems, power output from MHD generators, design problems of MHD generation, gas conductivity, seeding

Unit-5 **Teaching Hours:9**

Fuel Cells and Hydrogen

Electrochemical Effects and Fuel Cells: Principle of operation of an acidic fuel cell, Reusable cells, Ideal fuel cells, Other types of fuel cells, Comparison between acidic and alkaline hydrogen-oxygen fuel cells,

Efficiency and EMF of fuel cells, Operating characteristics of fuel cells, Advantages of fuel cell power plants, Future potential of fuel cells

Hydrogen Energy: Introduction, Hydrogen Production methods, Hydrogen storage, hydrogen transportation, utilization of hydrogen gas, hydrogen as alternative fuel for vehicles.

Text Books And Reference Books:

T1. Rai.G.D, “Non-Conventional Energy Sources”, 4 th edition,Khanna Publishers, New Delhi, 2011

T2. Domkundwar.V.M, Domkundwar.A.V, “Solar energy and Non-conventional sources of energy”,1st edition, Dhanpat rai & Co. {P} Ltd, New Delhi, 2010

Essential Reading / Recommended Reading

R1. S P Sukhatme, “Solar Energy: Principles of Thermal Collection and Storage”, 2ND EDITION , Tata McGraw Hill, 15TH REPRINT 2006

R2. J.A.Duffie and W.A.Beckman, “Solar Engineering of Thermal processes”,4TH edition,John Wiley, New York, April 2013

R3. Bockris and Srinivasan,“Fuel Cells”, Springer; Softcover reprint of hardcover 1st ed. 2006 edition

R4. Godfrey Boyle, “Renewable energy”, 2nd edition, Oxford University Press, 2010

R5. Khan.B, “Non-conventional Sources of energy”, 2nd edition, New Delhi, Tata McGraw Hill, 2009

R6. Tiwari.G.N, Ghosal.M.K, “Fundamentals of renewable energy sources”,1 st edition,UK, Alpha Science International Ltd, 2007

R7.Twidell.J.W and Weir.A.D, “Renewable Energy Resources”,2nd edition, UK, E.&F.N.Spon Ltd, 2015

Online Resources:

W1.https://www.toppr.com/guides/physics/sources-of-energy/non-conventional-sources-of-energy/

W2.https://www.jagranjosh.com/general-knowledge/nonconventional-sources-of-energy-1448698715-1

Evaluation Pattern

ASSESSMENT PATTERN FOR THEORY COURSE			
	Component	Assessed for	Scaled down to
1	CIA-1	20	10
2	CIA-2	50	25
3	CIA-3	20	10
4	Attendance	05	05
5	ESE	100	50
		TOTAL	100

ME551 - ANALYSIS LABORATORY (2021 Batch)

Total Teaching Hours for Semester:30 **No of Lecture Hours/Week:2**

Max Marks:50 **Credits:1**

Course Objectives/Course Description

To understand the concept of Finite Element Analysis and their applications, advantages and disadvantages. In this course students will learn/understand the

1} Steps involved in FEA

2} Factors influencing FEA results,

3} Assumptions on material properties and boundary conditions.

4} Fields of application in engineering problems.

5} Validation of FEA results obtained from CAE tools.

Course Outcome

CO1: Basic knowledge about FEM tools and their characteristics. {L2} {PO1,2,5}

CO2: Basic knowledge about selection of geometry and it simplification. {L2} {PO1,2,5}

CO3: Understanding of types of material data and application of boundary conditions. {L2} {PO1,2,5}

CO4: Defining the solution parameters and defining output requests. {L2} {PO1,2,5}

CO5: How to post-process and results interpretation. {L2} {PO1,2,5}

CO6: Validation of CAE results. {L2} {PO1,2,5}

Unit-1 **Teaching Hours:30**

List of Experiments

List of Experiments {If any}:	Practical Hours
1. Analysis of cantilever beam using Ansys APDL and Work Bench	3
2. Analysis of Simply supported beam using point, UDL and UVL	3
3. Modelling of CAM profile and flat faced/roller followers	3
4. Mesh size and mesh parameters.	2
5. FE mesh modelling	3
6. Loads and boundary conditions	2
7. Defining material properties and contacts	2
8. Defining Solution parameters and solving the problem	2
9. Post-processing of CAE results.	3
10. Basic checks to be done after simulation.	2
11. Validation of CAE Tool output through classical method	4
12. Introduction to Thermal/electro-thermal Simulation.	3

Text Books And Reference Books:

T1. Practical Finite Element Analysis by Nitin S Gokhale, Sanjay Deshpande et, al.

T2. Large strain Finite Element method- A Practical Course by Antonio Munjiza et, al.

Essential Reading / Recommended Reading

R1. Finte Element Analysis for Engineering and technology by R.Chandrupatla.

R2. Applied Finite Element Analysis by Larry J. Segerlind.

Online Resources:

W1. https://www.open.edu/openlearn/science-maths-technology/introduction-finite-element-analysis/content-section-1.5

W2. https://onlinecourses.nptel.ac.in/noc18_me08/preview

Evaluation Pattern

ASSESSMENT PATTERN FOR PRACTICAL COURSES		
ONLY PRACTICAL		
Component	Assessed for	Scaled down to
CIA	50	25
ESE	50	25
	TOTAL	50

ME552 - AUTOMATION LABORATORY (2021 Batch)

Total Teaching Hours for Semester:30 **No of Lecture Hours/Week:2**

Max Marks:50 **Credits:1**

Course Objectives/Course Description

- To understand the techniques involved in designing an experiment.
- To establish the basic statistical concepts in designing and experiment.
- To obtain the knowledge of taguchi method which is the efficient method of experimental design.

Course Outcome

CO1: Understand the operating principle, performance and selection procedure of hydraulic elements and machines {L 2}

CO2: Understand the working principle of actuators and evaluate actuator performance and justify selection of actuators for various applications {L 2}

CO3: Identify different types of control valves and understand their working principle and application. {L 3}

CO4: Design and analyze hydraulic circuits {L 3}

Unit-1 **Teaching Hours:30**

List of Experiments

List of Experiments	Practical Hours
1. Introduction to Pneumatic and Hydraulic symbols	2
2. To Control of a Casting Ladle movement using one-way flow control valve	4
3. To Feed a pin continuously using limit switches	2
4. To use a pneumatic timer in welding of plastic sheet	4
5. To determine the pressure for stamping a badge with uniform press using double acting cylinders	2
6. To control a furnace door using manual operated hydraulic valve	2
7. To control a surface Grinding machine	2
8. To determine the hydraulic pressure for a Drilling machine	2
9. To use hydraulic motor and accumulator for an Earth Drill used in construction site	2
10. To utilize the pressure sequence valve to handle a garbage box used in solid waste management.	2
11. Using directional control flow valves for distributing Billiard Balls	2
12. To feed a paper roll for the next stage of process	2
Total	30

Text Books And Reference Books:

1.T1. Anthony Esposito, “Fluid Power with Applications”, 7TH edition, Pearson Education, Inc, 2014.

2.T2. Andrew Parr, “Pneumatics and Hydraulics”, Jaico Publilishing Co, 2005.

Essential Reading / Recommended Reading

R1. S. R. Majumdar, “Oil Hydraulic systems Principles and Maintenance”, Tata Mc Graw Hill Publishing Company Ltd., 2001.

Evaluation Pattern

ASSESSMENT PATTERN FOR PRACTICAL COURSES			
ONLY PRACTICAL			
Component	Assessed for	Scaled down to	
CIA	50	25	
ESE	50	25	
	TOTAL	50	

NCCOE1 - NCC1 (2021 Batch)

Total Teaching Hours for Semester:45 **No of Lecture Hours/Week:3**

Max Marks:100 **Credits:3**

Course Objectives/Course Description

- This Course is offered for cadets of NCC who have successfully completed their B- Certificate.
- This Course is offered for the NCC cadets in the Open Elective course offered by the department during the 5th Semester.
- This course can be selected if and only if the cadet Successfully Completes the ‘B’- Certificate exam that is conducted centrally oraganized by the NCC Directorate.

Course Outcome

CO1: .

Unit-1 **Teaching Hours:9**

Introduction to NCC

The NCC- Aims, Objectives and Org of NCC-Incentives-Duties of NCC Cadet- NCC Camps: Types and Conduct. National Integration- Importance and Necessity- Factors affecting National Integration- Unity in Diversity.

Unit-2 **Teaching Hours:9**

Drill

Fundamentals of Foot Drill- Word of Command-Sizing- Salute- Basic Movements – Marching.

Fundamentals of Rifle Drill - Basic Movements- Introduction to .22 Rifle- Handling of .22 Rifle- Range procedure and Theory of grouping.

Unit-3 **Teaching Hours:9**

Social Services

Social Services-Community Development - Swachh Bharat Abhiyan - Social Service Capsule- Basics of Social Service- Rural Development Programmes- NGO’s.

Unit-4 **Teaching Hours:9**

Personality Development

Factors in personality Development- Self-Awareness-Empathy - Critical and Creative Thinking - Decision Making and Problem Solving- Communication Skills- Public Speaking- Group Discussions.

Unit-5 **Teaching Hours:9**

Disaster Management, Health and Hygiene

Organization - Types of Disasters - Essential Services Assistance - Civil Defense Organization - Natural Disasters- Man Made Disasters- Firefighting -Hygiene and Sanitation (Personal and Camp)- First Aid in Common Medical Emergencies and Treatment of Wound.

Text Books And Reference Books:

1.Airwing Cadet Handbook, Specialized Subject SD/SW, Maxwell Press, 2016.

2. Airwing Cadet Handbook, Common Subject SD/SW, Maxwell Press, 2015.

Essential Reading / Recommended Reading

1.Airwing Cadet Handbook, Specialized Subject SD/SW, Maxwell Press, 2016.

2. Airwing Cadet Handbook, Common Subject SD/SW, Maxwell Press, 2015.

Evaluation Pattern

1. The assessment will be carried out as overall internal assessment at the end of the semester for 100 marks based on the following.

- Each cadet will appear for 'B' Certificate exam which is centrally conducted by the Ministry of Defense, NCC directorate. The Total marks will be for 350.
- Each cadets score will be normalized to a maximum of 100 marks based on the overall marks Secured by each cadet.

VMEC511 - FUNDAMENTALS OF CAE SIMULATIONS (2021 Batch)

Total Teaching Hours for Semester:30 **No of Lecture Hours/Week:4**

Max Marks:50 **Credits:0**

Course Objectives/Course Description

- To simplify the geometry for Finite Element Modelling.
- To study the parameters influencing CAE outputs.
- To understand the material properties to be considered for FEA.
- To learn about boundary conditions.

Course Outcome

CO1: To Understand the concepts of Virtual Design and Testing.

CO2: To demonstrate the Concept of Finite Element Modelling and Analysis.

CO3: To be able to formulate the virtual model and analysis settings.

CO4: To understand the concept of FE modeling and analysis.

CO5: To be able to solve Problems of different domains like, structural, Thermal, Vibration, etc.,

Unit-1 **Teaching Hours:6**

INTRODUCTION

Definition of Finite Element Modelling, types of elements. Higher order elements. Notation for displacements, strains, forces and stresses. Co-ordinate systems, symmetry planes. Boundary conditions

Introduction to CAE Tools: Pre-processor, Solver types, Post-processing steps and features with simple examples.

Unit-2 **Teaching Hours:6**

Geometry Simplification

Identification of Critical/interested areas in geometry. Simplification of geometry through defeature options.

Unit-2 **Teaching Hours:6**

File management

Types of geometry files to be imported/exported. Details of files generated during CAE operations

Unit-3 **Teaching Hours:6**

Boundary conditions

Types of boundary conditions based on applications. Examples for each case.

Unit-3 **Teaching Hours:6**

Types of analysis

Static and dynamic analysis. Steady and Transient. Structural, Thermal and Vibration analysis. With examples.

Unit-4 **Teaching Hours:6**

Finite Element Modelling

Types of elements and their orders. Selection of element types based on output requirements. Elements Parameters setting.

Unit-4 **Teaching Hours:6**

Convergence Criteria

Methods used to get converged solutions. Example problems.

Unit-5 **Teaching Hours:6**

Verification of FEA results

Methods to verify FEA outputs, Simple calculations through classical/graphical methods.

Unit-5 **Teaching Hours:6**

Post-Processing

Output parameters like displacements, reaction forces, strains and stresses. Graphical representation of results. Output file management with results files.

Text Books And Reference Books:

T1. Gokhale Nitin S., "Practical Finite Element Analysis",.
T2. Rajasekaran S, "Finite Element Analysis",.
T3. Bi Zhuming," Finite Element Analysis Applications", Acad Pr.

Essential Reading / Recommended Reading

R1. S S Bhavikatti, "Finite Element Analysis ", New Age International Publishers.

Evaluation Pattern

Continous Internal Assessment-50Marks

BTGE631 - CORPORATE SOCIAL RESPONSIBILITY (2021 Batch)

Total Teaching Hours for Semester:30 **No of Lecture Hours/Week:2**

Max Marks:100 **Credits:2**

Course Objectives/Course Description

This course will familiarize the students with the concept of corporate social responsibility. The evolution of CSR has far reaching consequences on the development sector in India. The collaboration of companies and NGOs with the community has initiated a new paradigm of change in the country. The students will have an overview of the theories and the frameworks developed in the area of CSR. The paper will discuss a few prominent case studies of CSR.

Course Objectives

- To understand the concept of CSR and the theoretical underpinnings.
- To understand the stakeholder approaches.
- To provide an experiential, integrative, substantive, and high quality experience surrounding issues of Corporate Social Responsibility
- To provide participating students with a truly unique curriculum experience with field experience.

Course Outcome

CO1: The students will be able to demonstrate their understanding in general on CSR.

CO2: To exhibit their skill in executing the responsibilities and implementing different approaches in CSR.

CO3: The students will be able to critically evaluate the CSR programs of a corporate

Unit-1 **Teaching Hours:7**

Corporate social responsibility

Defining CSR. Aim and Objectives, Components of CSR, key drivers, History and Evolution of CSR in the Indian and international context, CSR policies and Governance, Laws and Regulations. Competencies of CSR Professionals.

Unit-2 **Teaching Hours:7**

Stakeholder Engagement

Stakeholder engagement, Interaction in a Multi-Stakeholder Context: CSR role on internal environment: Employees, Human Resource Management - labour security and human rights, Health and Safety.CSR role on External environment: 1) Customers: Consumer rights and movements affecting CSR; (2) Community: Community involvement, (3) Shareholders (4) Suppliers.

Unit-3 **Teaching Hours:6**

CSR towards Environment and Biodiversity

Environment: Need for Environmental assessments. Governments' response to CSR. Role of Biodiversity, Climate change and Environment in business. Environmental compliance.

Unit-4 **Teaching Hours:4**

Sustainability models

Benefits of CSR to Business. Factors hindering CSR activities in companies

Unit-5 **Teaching Hours:6**

Theories of CSR

Theories of CSR: A.B Carroll, Wood, and stakeholders Theories. The triple bottom line approach. Stakeholder engagement, Standards and Codes – SA 8000, the Global Compact, GRI, ISO 26000.

Text Books And Reference Books:

- Agarwal, S. (2008). *Corporate social responsibility in India*. Los Angeles: Response.
- Visser, W. (2007). *The A to Z of corporate social responsibility a complete reference guide to concepts, codes and organisations*. Chichester, England: John Wiley & Sons.
- Crane, A. (2008). *Corporate social responsibility: Readings and cases in a global context*. London: Routledge.
- Werther, W., & Chandler, D. (2006). *Strategic corporate social responsibility: Stakeholders in a global environment*. Thousand Oaks: SAGE Publications.

Essential Reading / Recommended Reading

- Baxi, C. (2005). *Corporate social responsibility: Concepts and cases: The Indian experience*. New Delhi, India: Excel Books.
- Visser, W. (2011). *The age of responsibility CSR 2.0 and the new DNA of business*. Chichester, West Sussex: John Wiley & Sons.

Evaluation Pattern

CIA 1 - 20 Marks

CIA 2 - 50 Marks

CIA 3 - 20 marks

ESE - 100 marks

BTGE632 - DIGITAL MEDIA (2021 Batch)

Total Teaching Hours for Semester:30 **No of Lecture Hours/Week:2**

Max Marks:100 **Credits:2**

Course Objectives/Course Description

This course provides students the insight on search engine optimization, social media and digital marketing techniques that helps them understand how each of the social media platforms works and how to strategize for any type of objectives from clients. Students will discover the potential of digital media space and will have hands on experience with different digital platforms.

Course Outcome

CO1: Understand search engine optimization (SEO) techniques and principles.

CO2: Gain expertise in managing and marketing on various social media platforms.

CO3: Apply digital marketing techniques to achieve specific business objectives.

Unit-1 **Teaching Hours:10**

Concepts

Website Hosting/Design/Development/Content, Fundamentals of SEO, Voice Search Optimization, Local SEO, Advanced/Technical SEO, SEO Audit, Competition Analysis, Concepts of Digital Marketing

Unit-2 **Teaching Hours:10**

Marketing

Marketing on platforms – Facebook/Twitter/LinkedIn/Instagram/YouTube, Quora, Basics of Video Editing, Inbound Marketing, Email Marketing, Digital Marketing Planning and Strategy, Marketing Automations and Tools

Unit-3 **Teaching Hours:10**

Growth Hacking

Ethical vs. Unethical, Funnels, KPI's, Viral Coefficient, Cohorts, Segments, Multivariate Testing, Lifetime Value of a Customer, Customer Acquisition Cost, Analytics Types, Tools, Project

Text Books And Reference Books:

Phillip J. Windley, "Digital Identity" O'Reilly Media, 2005

Essential Reading / Recommended Reading

Dan Rayburn, Michael Hoch, "The Business of Streaming and Digital Media", Focal Press, 2005

Evaluation Pattern

- CIA 1 - Evaluated out of 20, which will be converted to 10
- CIA 2 - Mid Semester Exam evaluated out of 50, which will be converted to 25
- CIA 3 - Evaluated out of 20, which will be converted to 10
- Total CIA Marks after conversion - 45
- Attendance Marks - 5
- ESE Evaluated out of 100, which will be converted to 50
- Total Marks = CIA (Total) + ESE + Attendance = 45 + 50 + 5 = 100

BTGE633 - FUNCTIONAL ENGLISH (2021 Batch)

Total Teaching Hours for Semester:30 **No of Lecture Hours/Week:2**

Max Marks:100 **Credits:2**

Course Objectives/Course Description

Students will be able to develop a clear understanding of the principles and characteristics of communication in professional settings. They would have developed skills for grammatical accuracy, precise vocabulary, clear style and appropriate tone for formal, professional communication

Course Outcome

1: Upon completing the syllabus students will be able to show a good grasp of the fundamentals of English language. Students will be able to deliver the topic orally and in writing with greater independence and greater linguistic correctness

2: Will be able to distinguish and discuss differences in English language structure between speech and writing as well as distinguish and discuss stylistic differences (formal and informal English)

3: Will be able to actively and independently participate in group discussions, can make successful attempt to persuade in decision making, and can withstand the pressures in interview.

4: Will be equipped to network in academic and work settings. Would be able to confidently appear in front of a larger crowd and give presentations

5: Will acquire skills in CV writing, cover letter writing and content generation

Unit-1 **Teaching Hours:6**

Verbal

- Training on Nouns, Pronouns, Homophones, Homonyms
- Verbs and Gender
- Training on Tenses
- Active Voice, Passive Voice and Sentence Formation
- Direct and Indirect Speech
- Adjectives and Adverbs

Unit-2 **Teaching Hours:6**

FORMAL COMMUNICATION

- Barriers of communication and effective solutions
- Workplace English
- Pleasantries and networking
- Cross-cultural understanding

Unit-3 **Teaching Hours:6**

WRITTEN Workplace English

- Professional Writing
- Analytical
- Instructional including writing MOMs
- Project Planning

- Creative writing
- Blogging
- Event management proposal meeting
- Professional communication – Email Etiquette, Cover letters, Resume

Unit-4 **Teaching Hours:6**

WRITTEN Academic Writing

- Application in technical fields and written communication
- Project writing, essays and theories
- Paper presentation skills and creative writing
- Final project writing

Unit-5 **Teaching Hours:6**

PUBLIC SPEAKING

- Training on Presentation Skills
- Body Language and Accent Training
- Voice projection
- Group Discussion Do's and Don'ts
- Getting individual feedback

Training on appropriate grooming code and body language in a professional workplace and delivery of apt elevator pitch

Text Books And Reference Books:

TEXT BOOKS

- High School English Grammar and Composition Book, Wren and Martin
- Writing At Work: Professional Writing Skills for People, Edward L. Smith and Stephen A. Bernhardt

Essential Reading / Recommended Reading

REFERENCE BOOKS

- English grammar in use book – Raymond Murphy
- WordPress to Go: How to Build a WordPress Website on Your Own Domain, from Scratch, Even If You Are a Complete Beginner Sarah McHarry.
- The Art of Public Speaking
- Textbook by Stephen E. Lucas
- True Professionalism, David Maister

Evaluation Pattern

Stress Interview/ Panel Discussion/Group

BTGE634 - GERMAN (2021 Batch)

Total Teaching Hours for Semester:30 **No of Lecture Hours/Week:2**

Max Marks:100 **Credits:2**

Course Objectives/Course Description

Description: Can understand and use familiar, everyday expressions and very simple sentences, which relate to the satisfying of concrete needs. Can introduce him/herself and others as well as ask others about themselves

Objectives

Impart the language and through that insight into the country and the culture.

Sensitize the students to the environment of a foreign country. To enable the students adapt to a new environment and culture.

Course Outcome

CO1: Can understand and use familiar, everyday expressions and very simple sentences, which relate to the satisfying of concrete needs.

CO2: Can introduce oneself and others as well as ask others about themselves ? e.g. where they live, whom they know and what they own ? and can respond to questions of this nature.

C03: Can handle everyday situations like shopping, eating out, visiting places, travelling, holidaying, requesting for information, making an appointment, cancelling an appointment, filling up a form etc.

Unit-1 **Teaching Hours:6**

INTRODUCTION, SELF AND OTHERS

Introduction: Greeting and saying goodbye, Introducing yourself and others**,** Talking about yourself and others**.**

Numbers**,** telephone numbers and mail-addresses**,** the alphabet (spelling)**,** countries and languages**.**

Question words, sentences, verbs and personal pronouns.

Unit-2 **Teaching Hours:6**

AROUND YOU? :FRIENDS, COLLEGEAUS

Hobbies, meeting friends, Weekdays, months and seasons, work and working times

Articles, verbs, Yes/ no questions, Plurals, The verbs “to have” and “to be”.

Unit-3 **Teaching Hours:6**

PLACES TO VISIT

Places in the city**,** asking for directions**,** Means of transport. Orientation in a city.

Imperative sentences.

Unit-4 **Teaching Hours:6**

FOOD

Shopping for food, conversation during food shopping, ordering food and drinks, general greetings during eating out.

Word position in sentence, accusative case.

Unit-5 **Teaching Hours:6**

TIME WITH FRIENDS

Telling time and organizing meetings with family and friends.

Making plans**,** Birthday invitations**,** in Restaurants**.**

Finding information in a text**,** event tips in the radio**,** leisure activities**,** brochures.

Possessive articles, Modal verbs ,simplePast tense (to have and to be)

Text Books And Reference Books:

- Netzwerk – Deutsch als Fremdsprache A1.

Publisher- Langenscheidt

Essential Reading / Recommended Reading

- Netzwerk – Deutsch als Fremdsprache A1.

Publisher- Langenscheidt

Evaluation Pattern

- **CIA I**

Content	**Marks**	**Nature of evaluation**
Self introduction Answering 2 Questions	4 6	Speaking
Filling an application form	10	Written

- **CIA II**

Written examination 50 marks

- **CIA III**

Content	Marks	Nature of evaluation
Hearing comprehension Reading comprehension	5 5	Listening to a track Written
Writing a letter	10	Written

- **SEMESTER EXAM**

Written examination 100 marks

BTGE635 - INTELLECTUAL PROPERTY RIGHTS (2021 Batch)

Total Teaching Hours for Semester:30 **No of Lecture Hours/Week:2**

Max Marks:100 **Credits:2**

Course Objectives/Course Description

Innovation is crucial to us and plays significant role in the growth of economy. Government policies and legal framework offer protection to new inventions and creative works. This course intends to equip students to understand the policies and procedures they may have to rely on for the purposed of protecting their inventions or creative works during the course of their study or employment.

The course consists of five units. Theories behind the protection of intellectual property and its role in promoting innovations for the progress of the society are the focus of first unit. Second unit deals with protection of inventions through patent regime in India touching upon the process of obtaining international patents. The central feature of getting patent is to establish new invention through evidence. This is done through maintaining experimental/lab records and other necessary documents. The process of creating and maintain documentary evidence is dealt in Unit 3. Computers have become an integral part of human life. Till 1980, computer related inventions were not given much importance and lying low but today they have assumed huge significance in our economy. Computer related inventions and their protection which requires special treatment under legal regimes are discussed in Unit 4. The last module deals with innovations in e- commerce environment.

Course Outcome

CO1: Understand the meaning and importance of intellectual property rights as well as different categories of intellectual property.

CO2: Understand the meaning of patentable invention, the procedure for filing patent applications, rights of the patentee and the different rights of patentee.

CO3: Maintain research records in the patent process, the process of patent document searching and how to interact with patent agent or attorney.

CO4: Understand the issues related to patenting of software, digital rights management and database management system.

CO5: Understand the intellectual property issues in e- commerce, evidentiary value of electronic signature certificates, protection of websites and the protection of semiconductor integrated circuits.

Unit-1 **Teaching Hours:6**

Introduction

Detailed Syllabus: Philosophy of intellectual property - Intellectual Property & Intellectual Assists – Significance of IP for Engineers and Scientists – Types of IP – Legal framework for Protection of IP – Strategies for IP protection and role of Engineers and Scientists.

Unit-2 **Teaching Hours:6**

Patenting Inventions

Meaning of Invention – Product and Process Patents – True inventor – Applications for Patent – Procedures for obtaining Patent – Award of Patent – rights of patentee – grounds for invalidation – Legal remedies – International patents

Unit-3 **Teaching Hours:6**

Inventive Activities

Research Records in the patent process – Inventorship - Internet patent document searching and interactions with an information specialist - Interactions with a patent agent or attorney - Ancillary patent activities - Technology transfer, patent licensing and related strategies.

Unit-4 **Teaching Hours:6**

Computer Implemented Inventions

Patents and software – Business Method Patents – Data protection – Administrative methods – Digital Rights Management (DRM) – Database and Database Management systems - Billing and payment – Graphical User Interface (GUI) – Simulations – E-learning – Medical informatics – Mathematical models

Unit-5 **Teaching Hours:6**

Innovations in E-Commerce

IP issues in e-commerce - Protection of websites – website hosting agreements – Copyright issues – Patentability of online business models – Jurisdiction – Digital signatures – Evidentiary value of Electronic signature certificates – Role of Certifying Authorities – Protection of Semiconductor ICs

Text Books And Reference Books:

1. V.J. Taraporevala's, Law of Intellectual Property, Third Edition, 2019

2. Elizabeth Verkey, Intellectual Property, Eastern Book Company, 2015

Essential Reading / Recommended Reading

1. Martin Adelman, Cases and Materials on Patent Law, 2015

2. Avery N. Goldstein, Patent Law for Scientists and Engineers, Taylor & Francis (2005)

Evaluation Pattern

CIA 1
Assignment description: Class test to identify the different aspects of IP.

Assignment details: MCQs

CIA II (MSE)
Assessment Description: Closed book exam
Assignment Details: Mid semester examination five questions need to be answered.

CIA III
Assessment Description: Students would be assessed on the understanding of the different forms of IP, relevant theoretical justifications of intellectual property protection and the relevant IP statute from practitioner's approach taught in the class and their ability to apply it correctly to the given problem and proposing solutions.

Assignment details: Students will be given a hypothetical legal problem in IP and will be required to write short essay, containing maximum 500 words. In the short essay, they have to answer the following questions
1. Identify the appropriate form of intellectual property.
2. Describe whether a pertinent theoretical justification meets or does not meet the respective form of IP.
3. Apply the correct principle of IP protection to the given case.
4. Evaluate the lacunae in the existing IP mechanism in comparison to international framework.
5. Devise a correct way of handling the lacunas.
ESE DETAILS -
Assessment Description : Closed book exam
Assignment Details: Five problem based questions need to be answered out of seven questions.

BTGE636 - INTRODUCTION TO AVIATION (2021 Batch)

Total Teaching Hours for Semester:30 **No of Lecture Hours/Week:2**

Max Marks:100 **Credits:2**

Course Objectives/Course Description

A student successfully completing this course will be able to:

Explain basic terms and concepts in air transportation, including commercial, military, and general aviation; air traffic control. Identify on the parts of an aircraft, classify the aircraft types and Construct models of an Aircraft. Understand the types of Aero engines and analyse the impact of meteorology in Aviation.

Course Outcome

CO1: Interpret the fundamental principles of flight based on theorems and parts of the Aircraft

CO2: Summarize the types of aircrafts and illustrate modelling of an Aircraft

CO3: Identify the types of Aero engines and Make use of Meteorology

Unit-1 **Teaching Hours:10**

Introduction to Principles of Flight

Development of Aviation- Introduction- Laws of Motion -Bernoulli's Theorem and Venturi Effect – Aero foil- Forces on an Aircraft- Flaps and Slats- Stalling- Thrust, Basic Flight Instruments- Introduction of Radar- Requirement of Navigation

Unit-2 **Teaching Hours:10**

Aircrafts and Aeromodelling

Airfield Layout- Rules of the Air- Circuit Procedure ATC / RT Procedure Aircraft Controls- Fuselage – Main Tail Plane Ailerons- Elevators- Rudder –Landing Gear.

Fighters- Transports- Helicopters- Foreign Aircraft History of Aero modelling- Materials used in Aero modelling - Types of Aero models

Unit-3 **Teaching Hours:10**

Aero Engines and Meteorology

Introduction of Aero engines - Types of Engines-Piston Engines -Jet Engines – Turboprop Engines, Importance of Meteorology in Aviation- Atmosphere - Clouds and Precipitation - Visibility – Humidity and Condensation

Text Books And Reference Books:

Text Books:

• Airwing Cadet Handbook, Specialized Subject SD/SW, Maxwell Press, 2016.

• Introduction to Aerospace Engineering: Basic Principles of Flight, Ethirajan Rathakrishnan, Wiley Press, 2021.

Essential Reading / Recommended Reading

Reference Books:

• An Observer's Guide to Clouds and Weather, Toby Carlson, Paul Knight, and Celia Wyckoff,2015, American Meteorological Society.

• Aero Engines, LNVM Society, 2007, L.N.V.M. Society Group of Institutes.

Evaluation Pattern

This Course do not have CIA 1/2/3. It has Overall CIA(out of 100 and will be Converted to 50) and ESE (out of 100 and will be converted to 50). Total Marks=100.

BTGE637 - PROFESSIONAL PSYCHOLOGY (2021 Batch)

Total Teaching Hours for Semester:30 **No of Lecture Hours/Week:2**

Max Marks:100 **Credits:2**

Course Objectives/Course Description

1. To understand various developmental changes that take place in human life and how people's thoughts, feelings, and behaviors are influenced by the social context consisting of actual, imagined, or implied presence of others.
2. To develop interpersonal awareness and skills, especially in the context of diversity and difference
3. To develop the psychosocial skills required in the professional world
4. To introduce the students to the existing theory and research in the past and contemporary social settings comprising viz, the intra-individual, inter-individual, and social factors that influence individual and group behavior.

Course Outcome

CO1: Understand the frameworks for the psychology of human development.

CO2: Show greater awareness of their thinking styles, relational styles and behavioral styles of functioning

CO3: Develop interpersonal awareness and skills, especially in the context of diversity and difference

CO4: Develop preparatory skills toward effective work-life balance

CO5: Develop an overall understanding of the psychosocial skills required in professional world

Unit-1 **Teaching Hours:7**

Introduction to Psychological Theories

Psychosocial development (Erickson)-Development of Cognition (Piaget)-Moral Development (Kohlberg)-Faith Development (Fowler)

Unit-2 **Teaching Hours:8**

Self-Awareness and Analysis

Thinking Styles (Cognitive distortions)- Interpersonal relationship styles (adult attachment theories)- Personality styles (Jung type indicator or Myers Briggs Type Indicator)- Coping styles: Emotion-focused and Problem-focused Analysis: Self-Analysis – Analyzing others-Body language –Facial expressions

Unit-3 **Teaching Hours:7**

Social Influences

Conformity: Asch's Research on Conformity-Factors Affecting Conformity; Compliance -The Underlying Principles - Ingratiation;Obedience to Authority-Destructive Obedience

Unit-4 **Teaching Hours:8**

Approaches to work motivation and job design

Overview of motivation - Need theories - Expectancy theory – Justice and citizenship theories - Goal-setting theory - Goals and self -regulation - Self-concept and individual differences in motivation - Pay and motivation - Motivation through job redesign

Text Books And Reference Books:

Baron, R. A., (2012), Psychology, 5th edition. Pearson Education India

Baron, R. A., & Branscombe, N. R. (2006). Social psychology. Pearson Education India.

Nelson Goud and Abe Arkoff (2005), Psychology and Personal Growth, Edition, Allyn and Bacon.

Essential Reading / Recommended Reading

Nelson Jones. (2006), Human Relationship skills: Coaching and self-coaching, 4th edition, Routledge.

Evaluation Pattern

CIA-1	CIA-2(MSE)	CIA-1	ESE	TOTAL
20	50	20	50	100

1. CIA =50 marks: CIA1/2/3 Marks would be converted to 45 and 5 marks for attendance
2. ESE would be for 50 marks

BTGE651 - DATA ANALYTICS THROUGH SPSS (2021 Batch)

Total Teaching Hours for Semester:30 **No of Lecture Hours/Week:2**

Max Marks:100 **Credits:2**

Course Objectives/Course Description

Course Description

Data Analysis using SPSS is specially designed to provide the requisite knowledge and skills in Data Analytics. The course covers concepts of Basics about Statistics, Data handling, Data Visualization, Statistical analysis, etc. This course will build a base for advance data analysis skills.

Course objectives

After the completion of the course, you should be able to:

a. Understand basic concepts of statistics and computer software SPSS
b. Select appropriate Statistical test for particular type of data
c. Recognize and interpret the output from statistical analysis

Course Outcome

CO1: Students will understand the concepts involved for analyzing Business data

CO2: Students will be able to understand how to use software like SPSS to analyse data

CO3: Students will be able to appreciate the use of Data Analytics for business decision making

Unit-1 **Teaching Hours:2**

Introduction to data Analysis

Introduction to Statistics and SPSS package viz.,, Types of data, data editing, coding, cleaning, outliers, missing data, import, export, data labeling, transforming data.

Unit-2 **Teaching Hours:2**

Data Visualization

Graphs, scatter plot, charts, frequency tables, histogram, Boxplot, pie chart, etc

Unit-3 **Teaching Hours:4**

Descriptive Statistics and Hypothesis testing

Basic statistics like mean, median, mode, SD, Examine relationship between variables example correlation, regression, etc., Compare groups to determine if there are significant differences between these groups example T-test, ANOVA etc., and to measure the association/independence using Chi-square., etc.

Unit-4 **Teaching Hours:4**

Logistic Regression

Application of logistic regression in SPSS using case study

Unit-5 **Teaching Hours:4**

Factor analysis

Application of factor analysis in SPSS using case study

Unit-6 **Teaching Hours:14**

Cluster Analysis and Discriminant analysis

Application of Cluster analysis and Discriminant in SPSS using case study

Text Books And Reference Books:

1. Andy field, "Discovering Statistics Using SPSS", SAGE Publications, Second Edition, 2006.

Essential Reading / Recommended Reading

1. Darren George|Paul Mallery, "SPSS for Windows Step by Step", Pearson, Tenth Edition, 2012.

Evaluation Pattern

CIA-1	**Unit 1,2,3,4**
Mid Term	**Unit1,2,3,4,5**
CIA-3	**Unit 6**

BTGE652 - DIGITAL MARKETING (2021 Batch)

Total Teaching Hours for Semester:30 **No of Lecture Hours/Week:2**

Max Marks:100 **Credits:2**

Course Objectives/Course Description

Course Description:

Developing a successful digital marketing strategy and implementation is both an art and science. It involves in-depth knowledge of dynamics of new media (Social Media, Mobile) and utilizing the right resources and marketing skills to design and launch successful customer engagement campaigns. Digital Marketing course has been designed to help students to understand both functional and management roles required to plan and execute effective Digital Marketing campaigns. The course also helps students gain an insight how to plan and implement Digital Marketing initiatives

Course Objectives:

- To apply the basics of digital marketing in the contemporary business scenario
- To utilize google ads for promotional activities
- To contrast various social media marketing platforms and activities
- To analyse the search engine optimization and search engine marketing strategies

To explain analytics pertaining to digital marketing initiatives

Course Outcome

CO1: Plan a digital marketing campaign as per client requirements

CO2: Apply google ads in digital campaigns

CO3: Analyse the appropriateness of social media marketing strategies with respect to campaign objectives

CO4: Examine the search engine optimization efforts

CO5: Appraise the digital marketing analytics related to the project

Unit-1 **Teaching Hours:5**

Introduction to Digital Marketing

Digital Marketing: Origin of digital marketing; Traditional Vs Digital Marketing; Internet Users in India; Grehan's 4Ps of digital marketing; The consumer decision journey; The P-O-E-M Framework; The digital landscape; Digital Marketing Plan.

Ethical Challenges: Frauds on the Web, Data and Identity Theft, Issue of Privacy. Information Technology Act, 2000.

Unit-2 **Teaching Hours:6**

Search Engine Marketing

Why pay for Search Advertising? Understanding Ad Placement; Understanding Ad ranks; Creating the first Ad campaign; Enhancing the Ad campaigns; Performance reports. Google Adsense.

Concept of Display Advertising; Types of display Ads; Buying Models; Display Plan; Targeting – Contextual targeting- Placement Targeting-Remarketing- Interest categories- Geographic Language Tagging; What makes a good Ad? Programmatic digital advertising; Analytics tools – viewability, on target reach, Ad fraud, Brand Health.

Unit-3 **Teaching Hours:9**

Social Media Marketing

How to build a successful social media strategy? Facebook Marketing- Facebook for Business-Anatomy of an Ad campaign – Adverts - Facebook Insights

Linkedin Marketing – Linkedin Strategy- Sales lead generation – Content Strategy – Linkedin Analytics – Targeting – Ad Campaign

Twitter Marketing – Getting started with Twitter – Building a content strategy – Twitter Ads – Twitter Analytics

Instagram Marketing – Objectives – Content Strategy – Style guidelines – Hashtags – Videos- Sponsored Ads – Apps – Generate leads

Unit-4 **Teaching Hours:6**

e-mail Marketing and Search Engine Optimisation

e-mail Marketing – Building a List- Content Strategies – e-mail newsletter – Automating e-mail marketing- Analytics.

Search Engine Optimisation – How search engine works? SEO Phases; On page Optimisation; Off-page Optimisation; Social Media Reach; Maintenance

Unit-5 **Teaching Hours:4**

Mobile Marketing and Web Analytics

Mobile Advertising – Mobile Marketing toolkit – Mobile Marketing Features – Mobile Analytics

Web Analytics – Key Metrics – Making web analytics actionable – Types of tracking codes

Text Books And Reference Books:

1. Seema Gupta. (2020). *Digital Marketing (2nd Ed).* Tata Mc Graw Hill

Essential Reading / Recommended Reading

1. Kerpen, D., Berk, R., Greenbaum, M. (2019). *Likeable social media, Third Edition: How To Delight Your Customers, Create an Irresistible Brand, & Be Generally Amazing On All Social Networks That Matter*. United Kingdom: McGraw-Hill Education.

2. Dr. Antony Puthussery (2020). *Digital Marketing: An Overview*. Notion Press.

3. Herman, J., Butow, E., Allton, M., Liu, S., Robinson, A. (2020). *Ultimate Guide to Social Media Marketing*. United States: Entrepreneur Press.

4. Marshall, P., Rhodes, M., Todd, B. (2020). *Ultimate Guide to Google Ads*. United States: Entrepreneur Press.

Evaluation Pattern

CIA 1 – Digital Marketing Plan – 20 Marks

CIA 2 – Google Ads – 10 Marks

CIA 3 – Social Media Marketing – 25 Marks

CIA 4 – Web Analysis (SEO) – 20 Marks

CIA 5 – Analytics – 20 Marks

Attendance – 5 Marks

CIA – Total Marks – 100 Converted to 50

ETE

Viva Voce – 50 Marks

Report – 50 Marks

ETE – 100 Marks – Converted to 50

Overall Marks – CIA + ESE = 100

BTGE653 - DIGITAL WRITING (2021 Batch)

Total Teaching Hours for Semester:30 **No of Lecture Hours/Week:2**

Max Marks:100 **Credits:2**

Course Objectives/Course Description

The course will develop the knowledge and skills required to write content for digital media. Students will learn how to craft writing for different areas of the media by focusing on genres such as profiles, informative pieces, articles and content pieces. Students will work on pitching and marketing ideas, discuss topics such as timelines, word counts and deadlines. The course will also examine the principles of reporting and the legal and ethical issues associated with content writing

The course intends to provide students with an in-depth understanding of the nature of digital content. The course will acquaint students with the techniques of writing simple but polished digital content. The subject will develop creativity in writing and imaginative approaches to digital content writing. The paper will help students understand the mechanics of content writing

Course Outcome

CO1: Students will learn how to write digital content for websites, blogs, and general social networking sites

CO2: Students will learn the importance of using hyperlinks to information sources when writing an article

CO3: Students will be able to differentiate between original and plagiarized content and develop mechanisms to avoid plagiarism

Unit-1 **Teaching Hours:6**

Introduction to Digital Writing

What is online writing, Narrative structure for online and digital stories, writing for university publications, Copyright, Ownership, and authorship, Approach to digital storytelling, Interactive narratives, sourcing information, exploring transmedia stories, data visualization, online identities and the self, alternate realities

Unit-2 **Teaching Hours:6**

Writing Techniques

Online news writing, headlines, sentences, links, tables and infographics, meaningful linking, effective illustrations, content strategy, message, media, style and tone, purposes, personas and scenarios

Unit-3 **Teaching Hours:6**

Writing for Newspapers

Journalistic writing-nature, process and styles, Concept of news-definitions, news values, nose for news, News writing- elements of news stories-Lead, body & closure; 5 Ws & 1 H, News writing structures- pyramid, inverted pyramid, hourglass, chronological, Newspaper design, Anatomy of a newspaper, Typography-font type, anatomy of type, type families, Readability & aesthetic principles, Page layout & design

Unit-4 **Teaching Hours:6**

Writing a Book Proposal

Process of book publishing, understanding book proposal, the importance of book proposal, book proposal structure, steps for writing a book proposal, some common mistakes made when writing a book proposal.

Unit-5 **Teaching Hours:6**

Writing Resume and Cover

Introduction to resume, the 3Fs of resume writing, parts of a resume, difference between CV and resume, characteristics of a good resume, anatomy of a resume, common mistakes made while writing a resume, introduction to cover letter, writing a cover letter for a job application, writing a cover letter for a book proposal, common mistakes made while writing a cover letter

Text Books And Reference Books:

1. Peter Clark, Roy. How to Write Short: Word Craft for Fast Times. Little Brown and Company. ISBN 0316204323.

2. Carroll, Brian. Writing and Editing for Digital Media, 1st edition. ISBN 978-0-415-99201-5. Routledge.

3. Writing New Media Theory and Applications for Expanding the Teaching of Composition; Anne Frances Wysocki, Johndan Johnson-Eilola, Cynthia L. Selfe, & Geoffrey Sirc Publication Year: 2004.

Essential Reading / Recommended Reading

1. Online Journalism: Reporting, Writing and Editing for New Media, Richard Craig.

2. Broadcast News Handbook: Writing, Reporting & Producing in a Converging Media World 2007, Third Edition, C.A. Tuggle, Forrest Carr and Suzanne Huffman

Evaluation Pattern

Introduction - 10

Content - 10

Structure - 10

Clarity- 10

Conclusion -10

BTGE654 - PHOTOGRAPHY (2021 Batch)

Total Teaching Hours for Semester:30 **No of Lecture Hours/Week:2**

Max Marks:100 **Credits:2**

Course Objectives/Course Description

The course introduces the art of photographic image making and printing. You will learn to see and appreciate light in a new way, learn to see and design shapes in the frame, and you will learn how to make fine prints. In this course, you will learn how to properly expose the camera, how to develop good images, and to make beautiful exhibition prints. This is not merely a technical course however the most important thing you can bring away from this course is a new sense of seeing. To be able to have a finer appreciation of light in its myriad manifestations, to discover meaning in images rather than words, or most importantly, how to make images, important and powerful in their own right, rather than merely "take pictures" is the main goal of this course.

Course Outcome

CO1: Ability to demonstrate understanding and clarity in content. Ability to read and interpretate photographs Ability to demonstrate knowledge of visual design and art.

CO2: Ability to demonstrate technical documentation of knowledge attained, process involved. Ability to read and interpretate photographs Ability to demonstrate knowledge of visual design and art.

CO3: Ability to demonstrate Quality and Comprehensiveness. Ability to read and interpretate photographs Ability to demonstrate understanding of material, structure and details and graphical understanding.

Unit-1 **Teaching Hours:10**

Introduction of Photography

Exposure to a variety of Analog and digital photographic techniques.

Basics of shots, sizes, and angles. Technical aspects such as exposure triangle, composition, framing, and introduction to lighting.

Printing The enlarger, set up, timer use, enlarging lenses, the test strip, developing procedures, contrast control with variable contrast filters, spotting and matting, archival processing.

Unit-2 **Teaching Hours:8**

Photographic Design

Introduction to contemporary and historic photographers and their works.

Understanding and applying visual design elements and principles in photography.

Unit-3 **Teaching Hours:8**

Appreciation of photography

Multiple photographic practices such as documentary photography, fine art photography and fashion photography, product photography and architecture photography.

Moral and theoretical issues attached to the medium, such as photography's relationships between truth, beauty, and fact, as well as the ethics of war photography.

Unit-4 **Teaching Hours:4**

Print media and Portfolio

Introduction to Print medium.

Portfolios (Digital Format)

Text Books And Reference Books:

1. Schaeffer J. P. (1998) *The Ansel Adams guide: Basic techniques of photography*, Boston: Little Brown and Company.

2. Horenstein, H. (1977) *Beyond Basic Photography: A Technical Manual*, Boston: Little Brown and Company.

3. Craven, G. M.(1990) *Object and Image: An Introduction to Photography*, New Jersey: Prentice-Hall, Englewood Cliffs.

Essential Reading / Recommended Reading

1. Peterson, B. (2016) *Understanding Exposure*, Fourth Edition, Random House USA Inc.

2. DK (2015) *Digital Photography Complete Course*, DK; Reissue edition.

3. Northrup T. & Northrup C. (2012) *Tony Northrup's DSLR Book: How to Create Stunning Digital Photography*, (2nd edition) Mason Press.

4. Hunter, F., Biver S. & Fuqua P. (2015) *Light Science & Magic: An Introduction to Photographic Lighting*, Routledge, ISBN-10: 0415719402.

5. Peterson B. (2017) *Understanding Colour in Photography: Using Colour, Composition, and Exposure to Create Vivid Photos,* Random House US, ISBN-10 : 9780770433116

Evaluation Pattern

The assessment pattern comprises of two components; the **Continuous Internal Assessment (CIA)** and the **End Semester Examination (ESE)**. The weightage of marks for subjects having both CIA marks, as well as ESE marks, have a ratio of 50:50.

CONTINUOUS INTERNAL ASSESSMENT (CIA): 50%

Continuous Internal Assessment for this course shall be conducted by the respective faculty in the form of different types of assignments. Students need to complete the assignments within the stipulated time for the award of marks.
A minimum of 50% in the CIA is required to appear for the End Semester Examination (ESE) of the course
Total CIA - 50 Marks

END SEMESTER EXAMINATION (ESE): 50%

Eligibility to appear for ESE is a score of a minimum of 50% in the CIA.
The course shall have a Viva Voce evaluated by an external examiner and internal examiner of the portfolio presentation.
Total ESE - 50 Marks

PASS CRITERIA

A student shall pass the course only on a minimum aggregate score (CIA+ESE) of 45% and a minimum CIA Score of 50% and an ESE score of 40%

BTGE655 - ACTING COURSE (2021 Batch)

Total Teaching Hours for Semester:30 **No of Lecture Hours/Week:2**

Max Marks:100 **Credits:2**

Course Objectives/Course Description

In this course the students are introduced different aspects of acting such as creating a character,

analyzing a script, working on voice and developing body language. At the end of the course the learners

will perform a monologue.

The course aims at the study and practice of Classical Acting. The development of individual imagination,

insight, skills and disciplines in the presentation of drama to audience.

Course Outcome

• To gain an understanding of acting principles and techniques

• Develop skills in the analysis and interpretation of dramatic texts for performance

• Explore basic voice and movement skills to create dramatic effect on stage

• Understand the basic production processes

• To perform a monologue

Unit-1 **Teaching Hours:10**

Unit 1

Inner characterization: History of acting, First performance,Art representation vs art of experiencing, Characterization and actor's notebook, Stanislavski's system, Objective and super-objective, Working with a script

Unit-2 **Teaching Hours:10**

Unit 2

Outer characterization : Stanislavski's system., Method of physical actions, Building character's body language, Building character's voice,

Unit-3 **Teaching Hours:10**

Unit 3

Performing a Monologue: Theatrical etude, Working with props, sets, light and costume, Creating atmosphere, Run-through,

Text Books And Reference Books:

Stanislavsky, Constantine. "An Actor prepares."

Essential Reading / Recommended Reading

Stanislavsky, Constantine. "An Actor prepares."

Evaluation Pattern

The assessment of the students is happening throughout the course and will be completed with the final monologue performance.

The assignments need to be submitted via Google Classroom by the given deadlines.

Actor's notebooks need to follow the given requirements.

Monologues will be performed live.

Completing all the given assignments throughout the course –20 marks

Submission of actor's notebook – 20 marks

Final monologue performance – 60 marks

BTGE656 - CREATIVITY AND INNOVATION (2021 Batch)

Total Teaching Hours for Semester:30 **No of Lecture Hours/Week:2**

Max Marks:100 **Credits:2**

Course Objectives/Course Description

To equip students with skill and aptitude for creativity and innovation through

1. Analyzing Problems:

   To stimulate curiosity in students to identify the areas of gaps and opportunities and solutions that can be provided
2. Creating Ideas:

   To stimulate creativity in students to come up with ideas for the areas of gaps and opportunities
3. To understand the creative process: Smart storming
4. Engineering Solutions: To understand Proof of Concept, Minimum Viable Proposition, and the Rapid Iteration Process

Course Outcome

CO-1: Develop an aptitude for creative thinking and problem solving in the areas that drive their interest.

CO-2: Understand the benefits of team work and collaborative thinking

CO-3: Understand the three keys aspects of the creative process viz. ACES

CO-4: Develop projects to understand the various principles and elements of creativity and innovation

CO-5: Apply the concepts of IPR to verify the projects which may be patentable, design and copyright protected

Unit-1 **Teaching Hours:6**

Introduction

Creativity & Innovation, A journey through major breakthrough innovations around the world., Collaborative Creativity

Unit-2 **Teaching Hours:6**

The Creative Process Part I (Analyzing Problems)

Analyzing Problems (Smart Storming), Theory and practice, Rethinking Thinking Imagination Observing, Abstracting, Recognizing Patterns, Forming Patterns

Unit-3 **Teaching Hours:6**

The Creative Process Part II (Creating Ideas)

Creative Thinking Techniques and Methods, Body Thinking, Empathizing (Design Thinking),

Dimensional Thinking Evolution and Evaluation of Ideas through design Thinking

Unit-4 **Teaching Hours:6**

The Creative Process Part III (Engineering Solutions)

Proof of Concept, Minimum Viable Proposition, Rapid Iteration Process

Unit-5 **Teaching Hours:6**

Innovation and IPR

Patents, Designs, Copyrights, Geographical Indications, Trademarks, Trade Secret

Text Books And Reference Books:

Activity Based Teaching. No text books and reference books

Essential Reading / Recommended Reading

Activity Based Teaching. No text books and reference books

Evaluation Pattern

This course consists of Overall Cia for 100 marks. No End Semester Examination for this course.

BTGE657 - PAINTING AND SKETCHING (2021 Batch)

Total Teaching Hours for Semester:30 **No of Lecture Hours/Week:2**

Max Marks:100 **Credits:2**

Course Objectives/Course Description

The course will develop the skills required to represent elements of nature and surrounding objects. Students will learn how to use the appropriate medium for representing their thought process. The course will examine the representation skills through exercises on sketching and rendering.

Course Outcome

CO3: Students will learn how to represent their ideas and thought processes diagrammatically through sketching and rendering.

Unit-1 **Teaching Hours:10**

Representation through Sketching

This unit will look at sketching as a medium to represent ideas and thought processes. Freehand Drawing Techniques, Landscape drawing .

Unit-2 **Teaching Hours:10**

Introduction to Watercolour Painting Techniques

Execute simple exercises in Collages to understand Flat Wash, Graded Wash, Wet on Dry, Wet on Wet. Techniques of Blooming, Splattering, Sponging will be used as a medium of representation. Study of brush strokes as a finish.How

Unit-3 **Teaching Hours:10**

Introduction to Soft Pastel Techniques

To create simple elements in nature Plants, Different types of Trees,water bodies in architecture. etc.

Text Books And Reference Books:

Drawing : (Ching, Francis D K)

Rendering With Pen and Ink / (Gill Robet W)

Essential Reading / Recommended Reading

milind mulick watercolor

sketchbook by milind mulick

Evaluation Pattern

The following courses do not have ESE. It has only Overall CIA (out of 100). This will be treated as the final ESE mark. Total mark = 100.

BTGE658 - DESIGN THINKING (2021 Batch)

Total Teaching Hours for Semester:30 **No of Lecture Hours/Week:2**

Max Marks:100 **Credits:2**

Course Objectives/Course Description

Course Description:

Throughout the course students will work on three different challenges; one focused on product design, one focused on service design and one focused on systems or business design. By starting with a very tangible challenge around product design, students will be able to hone their skills in the process before moving into more complex challenges around business and systems level design.

The course will be teamwork-oriented, but students will also complete readings and independent activities that support the group work and ensure individual depth of knowledge.

Course objectives:

- Expose students to the design process as a tool for innovation.
- Develop students' professional skills in client management and communication.

- Demonstrate the value of developing a local network and assist students in making lasting connections with the business community.
- Students develop a portfolio of work to set them apart in the job market.
- Provide an authentic opportunity for students to develop teamwork and leadership skills.

Course Outcome

CO1: Design Process 1. Students develop a strong understanding of the Design Process and how it can be applied in a variety of business settings 2. Students learn to research and understand the unique needs of a company around specific challenges 3. Students learn to build empathy for target audiences from different ?cultures? 4. Students learn to develop and test innovative ideas through a rapid iteration cycle 5. Students learn how to create physical prototypes / a visual representation of an idea 6. Students develop the willingness to take a risk and the ability to deal with failure

CO2: Professionalism 1. Students develop professional interpersonal and presentation skills 2. Students develop professional communication skills such as interviewing and crafting professional emails 3. Students learn to take ownership of the quality of their work and final products 4. Students understand their duty to maintain ethical standards in product and strategy design 5. Students understand the value of and have tools to develop a strong network

CO3: Leadership and teamwork 1. Students develop self awareness of personal leadership style and how to effectively work as a member of a team 2. Students collaborate on a variety of projects 3. Students develop communication skills necessary to facilitate high performance team formation and maintenance (e.g., leveraging the skills and abilities of all team members, valuing cross-disciplinary/cultural contributions, engaging in difficult conversations and resolving conflict)

Unit-1 **Teaching Hours:10**

Module 1: Intro to Design Thinking and Product Design

Introduction to Design Thinking
Introduction to Design Research Strategies
Introduction to Synthesis
Introduction to Ideation and Prototyping Strategies

Unit-2 **Teaching Hours:10**

Module 2: Team Work and Service Design

Team work discussion + Launch of Service challenge
Design Research - tools for observation + immersion
Journey mapping and ideation
Develop Final Presentations
Final Presentations and Leadership Styles discussion

Unit-3 **Teaching Hours:10**

Module 3: Business or Systems Design

Launch final challenge – system or student challenge
Business Model Canvas and Design Research
Visualizing ideas
Communicating ideas and effective storytelling
Final Presentations and class celebration

Text Books And Reference Books:

Essential References:

1. Design Your Thinking: The Mindsets, Toolsets and Skill Sets for Creative Problem-solving Hardcover – 23 December 2020, by Pavan Soni.
2. The Design Thinking Toolbox: A Guide to Mastering the Most Popular and Valuable Innovation Methods, by Michael Lewrick, Patrick Link, Larry Leifer.
3. Design Thinking: Understanding How Designers Think and Work, by Nigel Cross, BERG, Oxford, Newyork.

Essential Reading / Recommended Reading

Recommended References:

1. HBR's 10 Must Reads on Design Thinking (with featured article "Design Thinking" By Tim Brown) Paperback – 10 August 2020, by Publisher : Harvard Business Review Press (10 August 2020); Penguin Random House.
2. Change by Design, Revised and Updated: How Design Thinking Transforms Organizations and Inspires Innovation, by Tim Brown. Publisher HarperCollins, 2019; ISBN 0062856715, 9780062856715.
3. This is Service Design Thinking: Basics, Tools, Cases, by Marc Stickdorn, Jakob Schneider, Publisher BIS Publ., 2012; ISBN 906369279X, 9789063692797

Evaluation Pattern

Evaluation Pattern:

This courses do not have CIA-1-2-3 and ESE. It has only Overall CIA (out of 100). This will be treated as the final ESE.

The following case studies will be given for the evaluation of overall CIA.

1. Case Studies focused on product design.
2. Case Studies focused on service design.
3. Case Studies focused on systems or business design.

ME631 - DESIGN OF TRANSMISSION SYSTEM (2021 Batch)

Total Teaching Hours for Semester:45 **No of Lecture Hours/Week:3**

Max Marks:100 **Credits:3**

Course Objectives/Course Description

•Understanding of the design functions in mechanical engineering, steps involved in designing.

•Designing of general mechanical transmission elements shafts and keys, for axial, bending, torsional and combined loading conditions

•Designing of gears used for the power transmission. Types of different gears: helical, spur, bevel and worm gears.

•Designing of bearings used in mechanical transmission systems. Different types of bearings, lubrication of bearings, design of optimum lubrication conditions (minimum oil film thickness)

Course Outcome

CO 1: Calculate the bending and torsional effects on shafts for axial/bending/torsional loading conditions. {L3}

CO 2: Analyze the design parameters of helical, spur, bevel and worm gears subjected to dynamic and wear loads. {L3}

CO 3: Estimate the design parameters of cotter and knuckle joints, keys and couplings.{L3}

CO 4: Compute the breaking efficiency, lubricating parameters, locking friction, energy absorbed and heat generated in clutches and brakes. {L3}

CO 5: Select the appropriate type of transmission elements and analyze the dimensional parameters required for the real time application. {L4}

Unit-1 **Teaching Hours:9**

Design of Shafts

Design of Shafts: Torsion of shafts, design for strength and rigidity with steady loading, ASME codes for power transmission shafting, shafts under fluctuating loads and combined loads.

Unit-2 **Teaching Hours:9**

Design of Spur and Helical Gears

Spur Gears: Definitions, stresses in gear tooth: Lewis equation and form factor, Design for strength, Dynamic load and wear load.

Helical Gears: Definitions, formative number of teeth, Design based on strength, dynamic and wear loads.

Unit-3 **Teaching Hours:9**

Design of Bevel and Worm Gears

Bevel Gears: Definitions, formative number of teeth, Design based on strength, dynamic and wear loads.

Worm Gears: Definitions, Design based on strength, dynamic, wear loads and efficiency of worm gear drives.

Unit-4 **Teaching Hours:9**

Design of Keys, Couplings and Joints

Design of Cotter and Knuckle joints, Keys: Types of keys, Design of keys, Couplings: Rigid and flexible couplings, Flange coupling, Bush and Pin type coupling and Oldham's coupling.

Unit-5 **Teaching Hours:9**

Design of Clutches, Brakes and Lubrication Systems

Design of Clutches: Single plate, multi plate and cone clutches.

Design of Brakes: Block and Band brakes: Self-locking of brakes: Heat generation in Brakes.

Design of Lubrication: Lubricants and their properties, Mechanisms of Lubrication bearing modulus, coefficient of friction, minimum oil film thickness, Heat Generated, Heat dissipated, Bearing Materials, Examples of journal bearing and thrust bearing design.

Text Books And Reference Books:

T1.K Raghavendra, "Design of Machine Elements I", 1st edition, CBS Publication, 2017.

T2.K Raghavendra, "Design of Machine Elements II", 1st edition, CBS Publication, 2017.

T3.V. B Bhandari, "Design of Machine Elements", 4th edition, Tata McGraw Hill Publishing Company Ltd., 2016.

Essential Reading / Recommended Reading

R1.Richard Budynas and Keith Nisbett, "Shigley 's Mechanical Engineering Design", 10th edition, McGraw Hill, 2016.

R2.JBK Das, P. L. Srinivasa Murthy, "Design of Machine Elements I & II", Sapna Book House, 2009.

R3.Robert L. Norton, “Machine Design”, Pearson Education Asia, 2008.

R4.M. F. Spotts, T. E. Shoup, L. E. Hornberger, S. R. Jayram and C. V. Venkatesh, “Design of Machine Elements”, Pearson Education, 2006.

R5.K. Lingaiah, “Machine Design Data Handbook”, 2nd edition, McGraw Hill, 2010.

R6.K. Mahadevan and Balaveera Reddy, “Design Data Handbook”, 4th edition, CBS Publication, 2013.

R7.S C Pilli H.G. Patil, “Machine Design Data Handbook”, 2nd Edition, I K International Publishing Company Ltd., 2014.

Evaluation Pattern

ASSESSMENT PATTERN FOR THEORY COURSE			
	Component	Assessed for	Scaled down to
1	CIA-1	20	10
2	CIA-2	50	25
3	CIA-3	20	10
4	Attendance	05	05
5	ESE	100	50
		TOTAL	100

ME632P - HEAT TRANSFER (2021 Batch)

Total Teaching Hours for Semester:75 **No of Lecture Hours/Week:5**

Max Marks:100 **Credits:4**

Course Objectives/Course Description

•The aim of the course is to build a solid foundation in heat transfer exposing students to the three basic modes namely conduction, convection and radiation.

•Rigorous treatment of governing equations and solution procedures for the three modes will be provided, along with solution of practical problems using empirical correlations.

•The course will also briefly cover boiling and condensation heat transfer, and the analysis and design of heat exchangers.

Course Outcome

CO1: Able to formulate and analyze a heat transfer problem involving any of the three modes of heat transfer. {L4}

CO2: Able to obtain exact solutions for the temperature variation using analytical methods where possible or employ approximate methods or empirical correlations to evaluate the rate of heat transfer. {L3}

CO3: Able to design devices such as heat exchangers and also estimate the insulation needed to reduce heat losses where necessary. {L3}

Unit-1 **Teaching Hours:9**

Introduction

Introduction to three modes of heat transfer, Derivation of heat balance equation- Steady one dimensional solution for conduction heat transfer in Cartesian, cylindrical and spherical geometry, concept of conduction and film resistances, critical insulation thickness, heat transfer through pin fins

Unit-2 **Teaching Hours:9**

Transient conduction and Convection

Lumped system approximation and Biot number, Two dimensional conduction solutions for both steady and unsteady heat transfer-approximate solution to unsteady conduction heat transfer by the use of Heisler charts.

Heat convection, basic equations, boundary layers- Forced convection, external and internal flows- Natural convective heat transfer

Unit-3 **Teaching Hours:9**

Forced and Free Convection

Dimensionless parameters for forced and free convection heat transfer, Correlations for forced and free convection- Approximate solutions to laminar boundary layer equations (momentum and energy) for both internal and external flow- Estimating heat transfer rates in laminar and turbulent flow situations using appropriate correlations for free and forced convection.

Unit-4 **Teaching Hours:9**

Radiation

Interaction of radiation with materials, definitions of radiative properties, Stefan Boltzmann's law, black and gray body radiation, Calculation of radiation heat transfer between surfaces using radiative properties, view factors and the radiosity method.

Unit-5 **Teaching Hours:9**

Heat Exchangers

Types of heat exchangers, Analysis and design of heat exchangers using both LMTD and ε-NTU methods.

Boiling and Condensation heat transfer, Pool boiling curve

Introduction mass transfer, Similarity between heat and mass transfer

Text Books And Reference Books:

T1. F.P. Incropera, D.P. Dewitt, T.L. Bergman and A.S. Lavine, Fundamentals of Heat and Mass Transfer, John Wiley, Sixth Edition, 2007

T2. J.P. Holman and S. Bhattacharyya, Heat Transfer, McGraw Hill Education, Tenth Edition, 2017

T3 M. Thirumaleshwar, Fundamentals of heat and mass transfer, Pearson Education India, First Edition, 2006

Essential Reading / Recommended Reading

Reference Books:

R1. Y.A. Cengel, Heat Transfer: A Practical Approach, McGraw Hill, Second Edition, 2002

R2. P.S. Ghoshdastidar, Heat transfer, Oxford University Press, Second Edition, 2012

Online Resources:

W1. https://nptel.ac.in/courses/112101097/

W2. https://nptel.ac.in/courses/112105192/

Evaluation Pattern

COURSES WITH THEORY AND PRACTICAL				
	Component	Assessed for	Minimum marks to pass	Maximum marks
1	Theory CIA	30	-	30
2	Theory ESE	30	12	30
3	Practical CIA	35	14	35
4	Attendance	05	-	05
4	Aggregate	100	40	100

ME633P - AUTOMATION IN MANUFACTURING (2021 Batch)

Total Teaching Hours for Semester:75 **No of Lecture Hours/Week:5**

Max Marks:100 **Credits:4**

Course Objectives/Course Description

This course is designed to enlarge the application of automation in the field of manufacturing. It enables students to be acquainted with part programming and also makes them aware of types of automated systems and engineering application in manufacturing operations.

Course Outcome

CO1: Explain the fundamental concept of automation in manufacturing and industrial control systems. [L2]

CO2: Explain the implementation of quality and inspection techniques in automated control systems for production. [L2]

CO3: Discuss the principle of automation in production systems, manufacturing operations and material handling equipments. [L3]

CO4: Describe the concept of group technology and flexible manufacturing systems in automated manufacturing systems. [L3]

CO5: Compare the appropriate technologies that are used in industries for effective production and to support manufacturing. [L4]

CO6: Develop the CNC programming in milling and turning machines and also devise programs for industrial robots to perform manufacturing operations. [L4]

Unit-1 **Teaching Hours:9**

Introduction and Manufacturing Operations

Introduction: Need for automation, brief introduction to CIM and CNC, NC part programming, Manufacturing Support systems, Automation in Production systems, Automation principles & Strategies.

Manufacturing Operations: Manufacturing Operations, Product/Production Relationship, Production concepts and Mathematical Models & Costs of Manufacturing Operations.

Unit-2 **Teaching Hours:9**

Industrial Control and Automated Manufacturing Systems

Industrial Control System: Basic Elements of an Automated System, Advanced Automation Functions & Levels of Automation, Continuous versus Discrete control.

Automated Manufacturing Systems: Components of a Manufacturing systems, Classification of Manufacturing Systems, overview of Classification Scheme, Single Station Manned Workstations and Single Station Automated Cells.

Unit-3 **Teaching Hours:9**

Group Technology and Flexible Manufacturing System

Group Technology & Flexible Manufacturing Systems: Part Families, Parts Classification and coding, Production Flow Analysis, Cellular Manufacturing, Flexible Manufacturing Systems: What is an FMS, FMS Components and FMS Planning & Implementation Issues.

Unit-4 **Teaching Hours:9**

Quality Control Systems and Inspection Technologies

Quality Control Systems: Traditional and Modern Quality Control Methods, Taguchi Methods in Quality Engineering. Introduction to SQC Tools.

Inspection Technologies: Automated Inspection, Coordinate Measuring Machines Construction, operation & Programming, Software, Application & Benefits, Flexible Inspection System, Inspection Probes on Machine Tools, Machine Vision, Optical Inspection Techniques &

Unit-5 **Teaching Hours:9**

Manufacturing Support System

Manufacturing Support System: Process Planning, Computer Aided Process Planning, Concurrent Engineering & Design for Manufacturing, Advanced Manufacturing Planning, Just-in Time Production System, Comparisons of Lean & Agile Manufacturing.

Text Books And Reference Books:

T1. Automation, Production Systems and Computer Integrated Manufacturing, Mikell P. Groover, Pearson education. Fourth Edition, 2016.

T2. Serope Kalpakjian and Steven R. Schmid, Manufacturing – Engineering and Technology, Pearson education, 7th edition, 2018.

T3. S.Kant Vajpayee, “Principles of Computer Integrated Manufacturing,” PHI, Eastern Economy Edition, Paperback 1998.

Essential Reading / Recommended Reading

R1. G.H. Amber and P. S. Amber Anatomy of Automation, Prentice Hall, 1962.

R2. N. Viswanandham, Performance Modeling of Automated Manufacturing Systems, PHI, 1992.

R3. Krishna Kant, Computer Based Industrial Control, EEE-PHI, 2nd Edition, 2011.

Evaluation Pattern

COURSES WITH THEORY AND PRACTICAL				
	Component	Assessed for	Minimum marks to pass	Maximum marks
1	Theory CIA	30	-	30
2	Theory ESE	30	12	30
3	Practical CIA	35	14	35
4	Attendance	05	-	05
4	Aggregate	100	40	100

ME637 - SERVICE LEARNING (2021 Batch)

Total Teaching Hours for Semester:30 **No of Lecture Hours/Week:2**

Max Marks:50 **Credits:2**

Course Objectives/Course Description

1. To develop a habit of critical reflection for life-long learning in solving societal problems.

2. To work with a community and identify a specific need that can be addressed through Involvement and engineering practices.

Course Outcome

The students will be able to

CO1: Integrates the academic work with community service through student involvement. [L3] [PO1, PO2, PO3, PO4, PO12].

CO2: Develop and implement a project designed to respond to that identified community need. [L3] [PO1, PO2, PO3, PO4, PO12].

CO3: Create an awareness among the students as responsible citizen of the community/society. [L3] [PO1, PO2, PO3, PO4, PO12].

Unit-1 **Teaching Hours:30**

Service Learning

MODULE – I: Solid waste Management (Theory –6; Field Work -24)

Sources of solid wastes: Types and Sources of solid wastes. Need for solid waste management. Elements of integrated waste management and roles of stakeholders. Salient features of Indian legislations on management and handling of municipal solid wastes, plastics and fly ash.

Collection & segregation: Handling and segregation of wastes at source. Storage and collection of municipal solid wastes. Analysis of Collection systems. Need for transfer and transport. Transfer stations Optimizing waste allocation. Compatibility, storage, labelling wastes.

(OR)

MODULE– II: Managing stagnant Ponds (Theory –6; Field Work -24)

Purification of stagnant ponds :Introduction to Microbiology : Microbial ecology and Growth kinetics; Types of microorganisms ; aerobic vs. anaerobic processes

Biological Unit Processes :Aerobic treatment; Suspended growth aerobic treatment

processes; Activated sludge process and its modifications; Attached growth aerobic processes; Tricking filters and Rotating biological contactors; Anaerobic treatment; suspended growth, attached growth, fluidized bed and sludge blanket systems; nitrification, denitrification; Phosphorus removal.

Sludge Treatment: Thickening; Digestion; Dewatering; Sludge drying; Composting

Natural Wastewater Treatment Systems: Ponds systems.

(OR)

MODULE – III: Solar power (Theory – 6; Field Work - 24)

Solar energy: Global and National scenarios, Form and characteristics of renewable energy sources, Solar radiation, its measurements and prediction, Solar thermal collectors, flat plate collectors, concentrating collectors, Basic theory of flat plate collectors, solar heating of buildings, solar still, solar water heaters, solar driers; conversion of heat energy in to mechanical energy, solar thermal power generation systems

Solar photovoltaic: Principle of photovoltaic conversion of solar energy, types of solar cells and fabrication. Photovoltaic applications: battery charger, domestic lighting, street lighting, water pumping, power generation schemes, Basic concepts of Solar power, Solar cells. Applications of Solar-in Hospitals, automobiles, Air cooling, water cooling, Domestic Power generation, Industrial power generation, Traffic signals, Electronic equipments, refrigeration.

(OR)

MODULE – IV: Atmospheric pollution (Theory –6; Field Work -24)

Managing atmospheric pollution: Introduction to Atmospheric pollution-sources and causes. Methods of reducing pollution from vehicles, industries, domestic, urban and rural sources. Devising innovative pollution control devices& methods -filters, bags, traps, separators.

Text Books And Reference Books:

T1. S. P. Sukhatme, "Solar Energy, Principles of Thermal Collection and Storage," 6th Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 1990

T2. George Techobanoglous, "Integrated Solid Waste Management" McGraw - Hill, 1993.

T3. R.E.Landrefh and P.A.Rebers," Municipal Solid Wastes-Problems & Solutions", Lewis, 1997.

T4. Michael Allaby, "Fog, Smog and poisoned rain", Facts on File Incorporation, 2002. ISBN:0-8160-4789-8

T5. Arceivala S. J. and Asolekar S. R., Wastewater Treatment for Pollution Control and Reuse. 3rd Edition, Tata McGraw Hill, New Delhi, 2015.

Essential Reading / Recommended Reading

R1. George Techobanoglous and Thiesen Ellasen, "Solid Waste Engineering Principles and Management", Tata-McGraw – Hill, 1997.

R2. Blide A.D. and Sundaresan, B.B., "Solid Waste Management in Developing Countries", INSDOC, 1993.

R3. Arun Kumar Jain, Ashok Kumar Jain, B.C., Punmia, "Wastewater Engineering (Environmental Engineering-II), (Including Air Pollution)", Laxmi Publications Pvt. Ltd., 2014, ISBN 10: 8131805964, ISBN 13: 9788131805961.

Evaluation Pattern

	Category	Weightage for CIA
1	Courses with only Practical	50

ME644E11 - BASIC AEROSPACE ENGINEERING (2021 Batch)

Total Teaching Hours for Semester:45 **No of Lecture Hours/Week:3**

Max Marks:100 **Credits:3**

Course Objectives/Course Description

- To familiarize with the basics of aerodynamics.
- To familiarize with the basics of aircraft structures, systems & instruments.
- To give exposure to the power plants cased in Aircraft.

Course Outcome

Upon completion of this course, the students will be able to

CO1: To explain flow regimes (viscous/non-viscous; compressible/incompressible aerodynamics) and to estimate viscous and thermal effects.(L2)
CO2: To compute lift/drag of simple aero foil configurations.(L3)
CO3: To describe reference frames and derive general equations of motion for flight and orbital mechanics. (L2)
CO4: To apply equations of motion to determine aircraft performance in steady gliding, horizontal and climbing flight.(L3)
CO5: To derive aircraft performance diagram and flight envelope, in relation to aircraft morphology, lift-drag polar and engine performance.(L4)

Unit-1 **Teaching Hours:9**

Aircraft Configurations

Brief History- airplanes and Helicopters – Components of an airplane and their functions. Different types of flightvehicles, classifications, Basic instruments for flying

Unit-1 **Teaching Hours:9**

Introduction to Principles of Flight

Physical properties and structure of the atmosphere, Temperature, pressure and altituderelationships, Evolution of lift, drag and moment, different types of drag.

Unit-2 **Teaching Hours:9**

Introduction to Aerodynamics

Aerodynamic forces on aircraft,Basic characteristics of aerofoils, NACA nomenclature, Classification of NACA aerofoils, propagation of sound, Mach number, subsonic, transonic, supersonic, hypersonic flows.

Unit-2 **Teaching Hours:9**

Elements of Airplane Performance

Introduction, Equation of motion, Thrust required for level unaccelerated flight, Thrust available and maximum velocity, Power required for level unaccelerated flight, Power available and maximum velocity for reciprocating engine – propeller combination and jet engine, Altitude effect of power available and power required. Rate of climb, gliding flight, Absolute and Ceiling, Time of climb, Range & Endurance for propeller driven and jet air plane.

Unit-3 **Teaching Hours:9**

Aircraft Structures

General types of construction, Monocoque and Semi-monocoque - construction, Typical wing and fuselage Structures.

Unit-3 **Teaching Hours:9**

Landing Gears

Introduction to Landing Gears, Types of Landing Gears.

Unit-4 **Teaching Hours:9**

Systems and Instruments

Conventional control, Powered controls, Basic instruments for flying, typical systems for control actuation.

Unit-4 **Teaching Hours:9**

Aircraft Materials

Metallic and non-metallic materials, Use of aluminium alloy, titanium, stainless steel and composite materials.

Unit-5 **Teaching Hours:9**

Jet Propulsion

Basic ideas about piston, turboprop and jet engines – comparative merits, Propellers and Jet for thrust production.

Unit-5 **Teaching Hours:9**

Rocket Propulsion

Principle of operation of rocket, types of rocket and typical applications, Exploration into space, Use of multistage rockets.

Text Books And Reference Books:

1. Kermode,A.C., 'Flight without Formulae', Pearson,2004.

2. Shevell,R.S., Fundamentals of flights, Pearson education 2004.

Essential Reading / Recommended Reading

1. Anderson.J.D., Introduction to Flight, McGraw Hill,2010.

2. McKinley.J.L. and R.D. Bent, Aircraft Power Plants, McGraw Hill1993.

3. Pallet.E.H.J. Aircraft Instruments & Principles, Pearson 2010.

Evaluation Pattern

THEORY				
Component	**Assessed for**	**Scaled down to**	**Minimum marks to pass**	**Maximum marks**
CIA-1	20	**10**	-	**10**
CIA-2	50	**25**	-	**25**
CIA-3	20	**10**	-	**10**
Attendance	05	**05**	-	**05**
ESE	100	**50**	20	**50**
	TOTAL	**100**	-	**100**

ME644E4 - SUPPLY CHAIN MANAGEMENT (2021 Batch)

Total Teaching Hours for Semester:45 **No of Lecture Hours/Week:3**

Max Marks:100 **Credits:3**

Course Objectives/Course Description

Supply chain management is a concept of Planning, implementing and controlling the efficient, effective flow and storage of goods and materials between the point of origin and the point of consumption.

Course Outcome

CO1: To outline the business logistics and Outsourcing concepts to simplify the make or buy decision. {L2}

CO2: To discriminate the uncertain risky environment through Distribution Network Design and to appreciate the Supply Chain Network optimization models. {L3}

CO3: To Express the significance of Inventory and warehousing in relation to the SCM using Probabilistic inventory models and Warehousing Functions. {L3}

CO4: To design and optimize the routing for vehicles and to develop the right packaging. {L4}

CO5: To devise an organizational structure using Inter functional and inter-organizational management and control process framework. {L3}

Unit-1 **Teaching Hours:9**

Outsourcing

Outsourcing- Make vs buy approach – sourcing strategy.

Unit-1 **Teaching Hours:9**

Business Logistics

Business logistics and supply chain – importance, objectives and drivers. Strategy – planning, selecting the proper channel, performance measurement.

Unit-2 **Teaching Hours:9**

Decision Making

Planning Networks – Decision making under risk – Decision trees – Decision making under uncertainty. Distribution Network Design – Role - Factors Influencing Options, Value Addition.

Unit-2 **Teaching Hours:9**

Role of IT

Supply Chain Network optimization models. Logistics information system - Role of IT – Framework for IT adoption, Application of IOT in Supply Chain Management

Unit-3 **Teaching Hours:9**

Warehousing

Warehousing Functions – Types – Site Selection – Decision Model – Layout Design – Costing – Information Flows, Pricing and sourcing.

Unit-3 **Teaching Hours:9**

Inventory

Inventory–objectives, bullwhip effect, control - Probabilistic inventory models, Risk pooling, Vendor managed inventory, Multi-echelon inventory.

Unit-4 **Teaching Hours:9**

Packaging

Packaging- Design considerations, Material and Cost. Packaging as Unitisation. Consumer and Industrial Packaging.

Unit-4 **Teaching Hours:9**

Transportation

Transportation – Drivers, Modes, Measures - Strategies for Transportation, 3PL and 4PL, Vehicle Routing and Scheduling.

Unit-5 **Teaching Hours:9**

Organisation

Organization Structure – need and development. Organizational – Choices, Orientation and positioning. Interfunctional and inter-organizational management – alliances and partnerships.

Unit-5 **Teaching Hours:9**

Control

Control – Process framework, system details, information, measurement and interpretation.

Text Books And Reference Books:

T1. Ronald H. Ballou and Samir K. Srivastava," Business Logistics and Supply Chain Management", Pearson Education, Fifth Edition, 2007; ISBN: 9788131705841

T2. Sunil Chopra, Peter Meindl," Supply Chain Management-Strategy, Planning and Operation", Pearson Education, 2016, ISBN: 978-0-13-380020-3

Essential Reading / Recommended Reading

R1. Donald J Bowersox, David J Closs, "Logistics Management – The Integrated Supply Chain Process", Tata McGraw Hill, 2013; ISBN: 9780070068834

R2. Vinod V. Sople, "Logistics Management-The Supply Chain Imperative", Pearson Education; 2012; ISBN: 9788131768624.

R3. Coyle, Bardi, Langley, "The Management of Business Logistics: A Supply Chain Perspective", 7th edition; Thompson press; 2013; ISBN: 9788131500323.

R4. Mohanty R.P and Deshmukh S.G, "Supply chain theories and practices", Biztantra publications, 2008, ISBN: 9788177221916.

R5. Leenders, Johnson, Flynn, Fearon, "Purchasing and supply management", Tata McGraw Hill, 2013, ISBN:978-0072873795.

Online Resources:

W1. http://nptel.ac.in/courses

Evaluation Pattern

	Component	Assessed for	Scaled down to
1	CIA-1	20	10
2	CIA-2	50	25
3	CIA-3	20	10
4	Attendance	05	05
5	ESE	100	50
		TOTAL	100

ME651 - COMPUTER AIDED ENGINEERING LABORATORY (2021 Batch)

Total Teaching Hours for Semester:30 **No of Lecture Hours/Week:2**

Max Marks:50 **Credits:1**

Course Objectives/Course Description

1.To understand the techniques used in Geometry modelling of complex mechanical components

2.To understand the methods used in design validation/optimisation

3.To be able to design and confirm the mechanical components for the load carrying capacity.

4.To be able to define the FOS or maximum allowable load carrying capacity using CAE tools.

Course Outcome

CO1: To be able to create geometry model for the given machine component using CATIA. {L1} {PO1}

CO2: Understanding the methodologies to be used in FE modelling in addition to Types of elements and their properties. {L4}{PO1,PO2,PO3}

CO3: Understanding, simplification and applications of loads and boundary conditions. {L2}{PO1,PO2}

CO4: Post-processing techniques and validation of FEA results. {L2}{PO1,PO2,PO3}

Unit-1 **Teaching Hours:30**

List of Experiments

List of Experiments:	Practical Hours
Introduction to Geometry modelling	**2**
Introduction to Finite Element Modelling and Analysis	**4**
Crane Hook 3-D (CAD) modelling	**2**
Geometry simplification and FE modelling of Crane Hook	**2**
FE analysis and Post-processing results for Crane hook model	**4**
Results comparison/Validation of FEA results	**2**
IC Engine connecting rod 3-D (CAD) modelling	**2**
Geometry simplification and FE modelling of Connecting rod	**2**
FE analysis and Post-processing results for Connecting rod model	**3**

Results comparison/Validation of FEA results	**3**
Introduction to non-linear analysis	**2**
Introduction to Dynamic simulations.	**2**

Text Books And Reference Books:

T1. T.R. Chandrupatla, A.D Belegund, "Introduction to Finite Elements in Engineering", 3rd edition, PHI, 2002.

T2. S.S. Rao, "Finite Element Method in Engineering", 5th Edition, Elsevier, 2011.

Essential Reading / Recommended Reading

R1. Nitin S Gokhale and Sanjay S Deshpande, Practical Finite Element Analysis.

Online Resources:

W1. https://www.simscale.com/docs/simwiki/fea-finite-element-analysis/what-is-fea-finite-element-analysis/

W2. http://blog.spatial.com/finite-element-modeling

Evaluation Pattern

ASSESSMENT PATTERN FOR PRACTICAL COURSES			
ONLY PRACTICAL			
	Component	Assessed for	Scaled down to
1	CIA	50	25
2	ESE	50	25
		TOTAL	50

CSOE763E04 - BASICS OF MOBILE APPLICATION DEVELOPMENT (2020 Batch)

Total Teaching Hours for Semester:45 **No of Lecture Hours/Week:3**

Max Marks:100 **Credits:3**

Course Objectives/Course Description

This course introduces the basic design and development of Mobile application and focuses on development of mobile application for Android and IOS.

Course Outcome

CO1: Explain the concepts in mobile applications and its development.

CO2: Build an interface for mobile applications and web applications.

CO3: Design mobile application for Android platform using primitive UI features, SQLite and GPS.

CO4: Design a mobile application for the Android platform using advanced features like animations and graphics.

CO5: Develop a mobile application for IOS platform.

Unit-1 **Teaching Hours:9**

Introduction

Introduction to mobile applications – cost of development - Market and business drivers for mobile applications – Publishing and delivery of mobile applications – Requirements gathering and validation for mobile applications. Third party Frameworks. - Mobile Content- Mobile Applications.

Unit-2 **Teaching Hours:9**

Basic Design

Introduction to Web Services– Web service language Format –Web service creation: Case study– Mobile User Interface Design using Hybrid app development Tools. – Environment Setup- Understanding CLI - Layout – Building a simple app- Mobile Web Apps Using HTML5.Designing applications with multimedia and web access capabilities - Storing data in Firebase

Unit-3 **Teaching Hours:9**

Technology 1 ? Android 1

Introduction – Establishing the development environment – Android architecture – Activities and views – Interacting with UI – Persisting data using SQLite – Packaging and deployment – Interaction with server side applications – Using Google Maps, GPS and Wifi – Integration with social media applications.

Unit-4 **Teaching Hours:9**

Technology 1 ? Android 2

Animating views - Scenes and Transitions, Frame Animations, Tween Animation, scale, rotate, translate, alpha, Interpolation, Canvas/Drawing into a view, Surface View/Surface Holder, Adding animations - Crossfading two views. Graphics: Graphics & Multimedia – Introduction to Graphics, displaying bitmaps.

Unit-5 **Teaching Hours:9**

Technology 2 - IOS

Introduction to Objective C – iOS features – UI implementation – Touch frameworks – Data persistence using Core Data and SQLite – Location aware applications using Core Location and Map Kit – Integrating calendar and address book with social media application – Using Wifi – CASE STUDY- iPhone marketplace and mobile application development.

Text Books And Reference Books:

1. Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, Wiley Publications, 2012.

2. Chris Griffith, "Mobile App Development with Ionic, Revised Edition Cross-Platform Apps with Ionic, Angular, and Cordova", 2017

3. Charlie Collins, Michael Galpin and Matthias Kappler, "Android in Practice", Manning Publications Co., 2012.

4. Matt Neuburg , iOS 15 Programming Fundamentals with Swift: Swift, Xcode, and Cocoa Basics 1st Edition, 2021.

Essential Reading / Recommended Reading

1. James Dovey and Ash Furrow, "Beginning Objective C", Apress, 2012

2. David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, "Beginning iOS 6 Development: Exploring the iOS SDK", Apress, 2013.

Evaluation Pattern

●Continuous Internal Assessment (CIA) : 50% (50 marks out of 100 marks)

●End Semester Examination(ESE) : 50% (50 marks out of 100 marks)

Components of the CIA

CIA I : Subject Assignments / Online Tests : 10 marks

CIA II : Mid Semester Examination (Theory) : 25 marks

CIAIII : Quiz/Seminar/Case Studies/Project/Innovative Assignments/presentations/publications: 10 marks

Attendance : 05 marks

Total: 50 marks

ECOE7601 - AUTOMOTIVE ELECTRONICS (2020 Batch)

Total Teaching Hours for Semester:45 **No of Lecture Hours/Week:3**

Max Marks:100 **Credits:3**

Course Objectives/Course Description

The aim of this course is to enable student to understand the complete dynamics of automotive electronics, design and implementation of the electronics that contributes to the safety of the automobiles, add-on features, and comforts.

Course Outcome

CO1: Implement various control requirements in the automotive system

CO2: Comprehend dashboard electronics and engine system electronics

CO3: Identify various physical parameters that are to be sensed and monitored for maintaining the stability of the vehicle under dynamic conditions

CO4: Understand and implement the controls and actuator system pertaining to the comfort and safety of commuters

CO5: Design sensor network for mechanical fault diagnostics in an automotive vehicle

Unit-1 **Teaching Hours:9**

AUTOMOTIVE FUNDAMENTALS

Use of Electronics In The Automobile, Antilock Brake Systems, (ABS), Electronic steering control, Power steering, Traction control, Electronically controlled suspension

Unit-2 **Teaching Hours:9**

AUTOMOTIVE INSTRUMENTATION CONTROL

Sampling, Measurement and signal conversion of various parameters. Sensors and Actuators, Applications of sensors and actuators

Unit-3 **Teaching Hours:9**

BASICS OF ELECTRONIC ENGINE CONTROL

Integrated body- Climate controls, Motivation for Electronic Engine Control, Concept of An Electronic Engine Control System, Definition of General Terms, Definition of Engine Performance Terms, Electronic fuel control system, Engine control sequence, Electronic Ignition, air flow rate sensor, Indirect measurement of mass air flow, Engine crankshaft angular position sensor, Automotive engine control actuators, Digital engine control, Engine speed sensor ,Timing sensor for ignition and fuel delivery, Electronic ignition control systems, Safety systems,

Interior safety, Lighting, Entertainment systems

Unit-4 **Teaching Hours:9**

VEHICLE MOTION CONTROL AND AUTOMOTIVE DIAGNOSTICS

Cruise control system, Digital cruise control, Timing light, Engine analyzer, On-board and off-board diagnostics, Expert systems. Stepper motor based actuator, Cruise control electronics, Vacuum – antilock braking system, Electronic suspension system Electronic steering control, Computer-based instrumentation system, Sampling and Input\output signal conversion, Fuel quantity measurement, Coolant temperature measurement, Oil pressure measurement, Vehicle speed measurement, Display devices, Trip-Information- Computer, Occupant protection systems

Unit-5 **Teaching Hours:9**

FUTURE AUTOMOTIVE ELECTRONIC SYSTEMS

Alternative Fuel Engines, Collision Wide Range Air/Fuel Sensor, Alternative Engine, Low Tire Pressure Warning System, Collision avoidance Radar Warning Systems, Low Tire Pressure Warning System, Radio Navigation, Advance Driver information System. Alternative-Fuel Engines, Transmission Control , Collision Avoidance Radar Warning System, Low Tire Pressure Warning System, Speech Synthesis Multiplexing in Automobiles, Control Signal Multiplexing, Navigation Sensors, Radio Navigation, Sign post Navigation , Dead Reckoning Navigation Future Technology, Voice Recognition Cell Phone Dialing Advanced Driver information System, Automatic Driving Control

Text Books And Reference Books:

T1.A William B. Ribbens, "Understanding Automotive Electronics",6th Edition SAMS/Elsevier publishing, 2007

Essential Reading / Recommended Reading

R1. Robert Bosch Gmbh,"Automotive Electrics and Automotive Electronics-Systems and Components, Networking and Hybrid Drive", 5th Edition, Springer, Vieweg, 2007

Evaluation Pattern

Components of the CIA
CIA I : Subject Assignments / Online Tests : 10 marks
CIA II : Mid Semester Examination (Theory) : 25 marks
CIAIII:Quiz/Seminar/Case Studies/Project/Innovative Assignments/presentations /publications : 10 marks
Attendance : 05 marks
Total : 50 marks
Mid Semester Examination (MSE) : Theory Papers:
The MSE is conducted for 50 marks of 2 hours duration.
Question paper pattern; Five out of Six questions have to be answered. Each question carries 10 marks
End Semester Examination (ESE):
The ESE is conducted for 100 marks of 3 hours duration.

EEOE731 - BATTERY MANAGEMENT SYSTEMS FOR ELECTRICAL VEHICLES (2020 Batch)

Total Teaching Hours for Semester:45 **No of Lecture Hours/Week:3**

Max Marks:100 **Credits:3**

Course Objectives/Course Description

This course introduce battery chemistry, traction batter & regulation, parameter estimation, battery state estimation, protection and BMS

Course Outcome

CO1: To understand the traction battery chemistry

CO2: To demonstrate the need for Battery Management Systems in Lithium ion battery packs.

CO3: To understand the control Algorithms used to determine State of Charge

CO4: To understand the need of Thermal Management System for Battery life extension.

CO5: To identify the charging and discharging controllers and their regulations

Unit-1 **Teaching Hours:9**

Battery Chemistry

Lead Acid Battery – Construction- Working – Characteristics – Li ion Battery - Construction- Working – Characteristics- LiFePo Battery- NiMH - Construction- Working – Characteristics – Fuel Cells- Construction- Working – Characteristics- Introduction to latest batteries- Zinc Air- Aluminium Battery.

Unit-2 **Teaching Hours:9**

Traction Battery & Regulation

Li-ion cell - constant-voltage control- constant-power control-EV battery pack sizing-. Voltage sensing - High-voltage control- Battery pack protection- interface- performance management- diagnostics- Cell Aging- Cell failure-BMS topologies.

Unit-3 **Teaching Hours:9**

Parameter Estimation

SoC measurement – Need for SoC- terminal voltage method- Coulumb counting method- Joule counting method- SoC state estimation – Kalman filter method. SoH measurement- Cell Degradation – cell capacity estimation- Total capacity estimation.

Unit-4 **Teaching Hours:9**

Battery Pack Protection

Battery Failure Causes- Thermal Runaway Model- Internal Short Circuit Detection- Gas Sensing for Battery Venting Detection- Fault Detection in Modules.

Unit-5 **Teaching Hours:9**

Battery Management System Boards

Types of BMS Boards- Overcurrent protection- Over voltage protection – Cell balancing – Case study : Connection diagram – Battery pack charger.

Text Books And Reference Books:

 Advances in Battery Technologies for Electric Vehicles- A Volume in Woodhead Publishing Series in Energy, Bruno Scrosati, Jürgen Garche and Werner Tillmetz, Elsevier, 2015

Essential Reading / Recommended Reading

 Electric Vehicle Battery Systems, Sandeep Dameja, Elsevier, 2002

Evaluation Pattern

ASSESSMENT - ONLY FOR THEORY COURSE (without practical component)

Continuous Internal Assessment (CIA) : 50% (50 marks out of 100 marks)

End Semester Examination(ESE) : 50% (50 marks out of 100 marks)

Components of the CIA

CIA I : Subject Assignments / Online Tests : 10 marks

CIA II : Mid Semester Examination (Theory) : 25 marks

CIAIII: Quiz/Seminar/Case Studies/Project/ Innovative assignments/ presentations/ publications : 10 marks

Attendance : 05 marks

Total : 50 marks

Mid Semester Examination (MSE): Theory Papers:

The MSE is conducted for 50 marks of 2 hours duration.

Question paper pattern; Five out of Six questions have to be answered. Each question carries 10 marks

End Semester Examination (ESE):

The ESE is conducted for 100 marks of 3 hours duration.

The syllabus for the theory papers are divided into FIVE units and each unit carries equal Weightage in terms of marks distribution.

Question paper pattern is as follows.

Two full questions with either or choice will be drawn from each unit. Each question carries 20 marks. There could be a maximum of three sub divisions in a question. The emphasis on the questions is to test the objectiveness, analytical skill and application skill of the concept, from a question bank which reviewed and updated every year

The criteria for drawing the questions from the Question Bank are as follows

50 % - Medium Level questions

25 % - Simple level questions

25 % - Complex level questions

ME733P - VIBRATIONS AND CONTROL (2020 Batch)

Total Teaching Hours for Semester:75 **No of Lecture Hours/Week:5**

Max Marks:100 **Credits:4**

Course Objectives/Course Description

1. To be able to obtain linear vibratory models of vibratory system to determine its response of SDOF.
2. To be able to write the differential equation of motion of vibratory systems.
3. To be able to make free and forced (harmonic, periodic, non-periodic) vibration analysis of single and multi-degree of freedom linear systems.
4. To be able to determine vibratory responses of Two DOF and Multi DOF systems.
5. To be able obtain linear mathematical models of real-life engineering systems.

Course Outcome

CO1: Understand the fundamental concepts of mechanical vibrations. {L2}

CO2: Develop a mathematical model for a physical system and derive the governing differential equations. {L2}

CO3: Estimate the natural frequencies of single DOF undamped and damped, free and forced vibratory systems. {L3}

CO4: Estimate natural frequencies and mode shapes for 2 DOF undamped free longitudinal and torsional vibratory systems. {L4}

CO5: Describe vibration measuring instruments for industrial / real life applications along with suitable method(s) for vibration control. {L3}

Unit-1 **Teaching Hours:9**

BASIC CONCEPTS OF VIBRATIONS

BASIC CONCEPTS OF VIBRATIONS: Types of vibrations, Definitions, Simple Harmonic Motion (S.H.M.), Work done by harmonic force, Principle of super position applied to SHM, Beats, Fourier theorem and problems.

Unit-2 **Teaching Hours:10**

Free Vibrations (Damped & Undamped) - SDOF

UNDAMPED FREE VIBRATIONS (SINGLE DEGREE OF FREEDOM): Derivations for spring-mass systems, Methods of Analysis, Natural frequencies of simple systems, Springs in series and parallel, Torsional and transverse vibrations, Effect of mass of spring and Problems.

DAMPED FREE VIBRATIONS (SINGLE DEGREE OF FREEDOM): Types of damping, Analysis with viscous damping - Derivations for over, critical and under damped systems, Logarithmic decrement and Problems.

Unit-3 **Teaching Hours:9**

Forced Vibrations -SDOF

FORCED VIBRATIONS (SINGLE DEGREE OF FREEDOM): Introduction, Analysis of forced vibration with constant harmonic excitation – magnification factor, rotating and reciprocating unbalances, excitation of support (relative and absolute amplitudes), force and motion transmissibility, Energy dissipated due to damping and Problems.

Unit-4 **Teaching Hours:9**

Two Degrees of Freedom Systems

TWO DEGREES OF FREEDOM SYSTEMS: Principal modes of vibrations, Normal mode and natural frequencies of systems (without damping) – Simple spring-mass systems, masses on tightly stretched strings, double pendulum, torsional systems.

Unit-5 **Teaching Hours:8**

Vibration Measuring and Controlling

VIBRATION MEASURING INSTRUMENTS: Vibrometers, Accelerometer, Frequency measuring instruments, Vibration exciters and problems.

VIBRATION CONTROLLING TECHNIQUES: Vibration isolation, tuned absorbers, untuned viscous dampers, damping treatments.

Unit-6 **Teaching Hours:30**

List of Experiments

1. Determination of natural frequency, logarithmic decrement, damping ratio, and damping coefficient in a single degree of freedom vibrating systems (longitudinal and torsional) Balancing of rotating masses.
2. Determination of the critical speed of a rotating shaft.
3. Determination of Fringe constant of Photo elastic material using. a. Circular disc subjected to diametral compression. b. Pure bending specimen (four-point bending).
4. Determination of stress concentration using Photoelasticity for simple components like plate with a hole under tension or bending, circular disk with circular hole under compression, 2D Crane hook.
5. Determination of equilibrium speed, sensitiveness, power and effort of Porter/Prowel /Hartnel Governor. (Only one or more).
6. Determination of Pressure distribution in Journal bearing.
7. Determination of Principal Stresses and strains in a member subjected to
8. combined loading using Strain rosettes.
9. Determination of stresses in curved beam using strain gauge.
10. Experiments on Gyroscope (Demonstration only).

Text Books And Reference Books:

T1. S. S. Rao, “Mechanical Vibrations”, 5th edition, Pearson Education Inc, 2010.

T2. V. P. Singh, “Mechanical Vibrations”, 3rd edition, Dhanpat Rai & Company, 2014 (reprint).

Essential Reading / Recommended Reading

R1. W. T. Thomson, M. D. Dahleh and C. Padmanabhan, “Theory of Vibration with Applications”, 5th edition, Pearson Education Inc, , 2008.

R2. Schaum’s outline Series, “Mechanical Vibrations: S. Graham Kelly”, Special Indian Edition, Tata McGraw Hill, , 2007.

R3. J. S. Rao & K. Gupta, “Theory and Practice of Mechanical Vibrations”, 2nd edition, New Age International Publications, New Delhi, 2014 (reprint).

R4. G. K.Grover, “Mechanical Vibrations”, 8th edition, Nem Chand and Bros, 2009.

Evaluation Pattern

COURSES WITH THEORY AND PRACTICAL										
THEORY						PRACTICAL				
	Component	Assessed for	Scaled down to	Min. marks to pass	Max. marks	Component	Assessed for	Scaled down to	Min. marks	Max. marks
1	CIA-1	20	**10**	-	**10**	Overall CIA	**50**	**35**	**14**	**35**
2	CIA-2	50	**10**	-	**10**					
3	CIA-3	20	**10**	-	**10**					
4	Attendance	05	**05**	-	**05**	Attendance	**NA**	**NA**	**-**	**-**
5	ESE	100	**30**	12	**30**	ESE	**NA**	**NA**	**-**	**-**
		TOTAL	**65**	-	**65**	TOTAL		**35**	**14**	**35**

ME741E1 - FLEXIBLE MANUFACTURING SYSTEM (2020 Batch)

Total Teaching Hours for Semester:45 **No of Lecture Hours/Week:3**

Max Marks:100 **Credits:3**

Course Objectives/Course Description

- Explain the concept of group technology, and how it relates to cellular manufacturing.
- Over all view how different types of FMS may be specified.
- Apply knowledge of basic components of an FMS.
- State the five categories of FMS layout.
- Specify the benefits of a successful FMS implementation.
- Outline the Major issues of planning for the creation of FMS.
- Specify the types of quantitative analysis that may be used with regard to FMS.
- Explain the concept of the bottleneck model and the extended bottleneck model.
- State points that arise from FMS quantitative analysis research.

Course Outcome

CO1: Explain about the concept of FMS along with its application, configurations, and layouts in industries. {L2}

CO2: Discuss the material handling and storage system of FMS implemented in industrial sectors. {L2}

CO3: Describe the DNC and tool management system of FMS. {L3}

CO4: Categorize the part families in cellular manufacturing and Flexible manufacturing system. {L4}

CO5: Appraise the economic and technological justification for FMS. {L4}

Unit-1 **Teaching Hours:9**

FMS-An Overview, Development & Implementation of An FMS

FMS – An Overview: Definition of an FMS – Types of flexibility and flexibility criteria in manufacturing, Types & Configurations and FMS concepts – FMS applications and benefits.

Development & Implementation of an FMS: Planning phase – Integration –System configuration – FMS layouts – FMS Project development steps.

Unit-2 **Teaching Hours:9**

Automated & Material Handling, Storage

Automated & Material Handling: Functions, Types, Analysis of material handling equipment, Design of Conveyor & AGV Systems, Problems.

Storage: Storage system performance – AS/RS – Carousel storage system – WIP storage system – interfacing handling storage with manufacturing, Problems.

Unit-3 **Teaching Hours:9**

Distributed Numerical Control, Tool Management of FMS

Distributed Numerical Control: DNC system, Communication between DNC computer & machine control unit, Hierarchical processing of data in DNC system – Features of DNC systems.

Tool Management of FMS: Tool strategies, tool identification, Tool monitoring, and fault detection Wash stations, Inspection stations. CMM, Sequence of operations, Advantages, Types of CMM, Problems.

Unit-4 **Teaching Hours:9**

Group Technology, Modeling and Analysis of FMS

Group Technology: Part families, Parts classification and coding Production flow analysis, Applications of Group technology, Quantitative analysis in cellular manufacturing, Problems, and comparison between cellular manufacturing and FMS.

Modeling and Analysis of FMS: Quantitative analysis of Flexible Manufacturing System, problems. Petri net modeling techniques.

Unit-5 **Teaching Hours:9**

FMS Relational, Flexible Assembly System

FMS Relational: Economic and technological justification for Flexible Manufacturing System, typical case studies – Future prospects.

Flexible Assembly System: Flexible assembly system hardware components and features, design planning, and scheduling of FAS

Text Books And Reference Books:

1. V Parrish D J, Butter Worth – Heinemann Flexible manufacturing", Ltd Oxford, 1993
2. 2. Groover M P "Automation, Production Systems and Computer Integrated Manufacturing", Prentice Hall India {P} Ltd, 2008.
3. 3. Kusiak A "Intelligent Manufacturing Systems", Prentice Hall, Englewood Clitts, NJ,1990.
4. 4. William W. Luggen "Flexible Manufacturing Cells & Systems", prentice hall, NJ.1990.

Essential Reading / Recommended Reading

1. CONSIDINE D M, and CONSIDINE G D, Standard Handbook of Industrial Automation, Chapman and Hall, London, 1986.
2. Viswanatham N & Narahari Y "Performance Modeling of Automated Manufacturing Systems", Prentice Hall of India {P} Ltd, 2009.
3. Ranky P G "The design and Operation of FMS", IFS Pub. Uk, 1988.
4. Dr.H.K.Shivanand "Flexible Manufacturing System", Dhanpat Rai Publications, New Delhi. 2006.
5. Tadeusz Sawik "Production Planning and Scheduling in Flexible Assembly Systems", Springer, 2012.

Evaluation Pattern

ASSESSMENT PATTERN FOR THEORY COURSES					
	Component	Assessed for	Scaled down to	Min. marks to pass	Max. marks
1	CIA-1	20	**10**	-	**10**
2	CIA-2	50	**25**	-	**25**
3	CIA-3	20	**10**	-	**10**
4	Attendance	05	**05**	-	**05**
5	ESE	100	**50**	20	**50**
		TOTAL	**100**	-	**100**

ME741E6 - ADVANCED AUTOMOTIVE ENGINEERING (2020 Batch)

Total Teaching Hours for Semester:45 **No of Lecture Hours/Week:3**

Max Marks:100 **Credits:3**

Course Objectives/Course Description

- To impart knowledge to students in various systems of Automobile Engineering.
- To learn the fundamental principles, construction and auxiliary systems of automotive engines.
- To have excellent vision with ability to see small details at close range of students.
- To utilize and build upon the current knowledge of modern automotive manufacturing and engineering.
- To have strong logical and analytical skills in Automotive Engineering.

Course Outcome

CO-1: Explain the fundamental principles, construction, and auxiliary systems used in automotive engines. {L2}

CO-2: Demonstrate the improvements in the engine performance using superchargers and turbochargers. {L3}

CO-3: Describe the concept of injection and ignition systems used in an automotive. {L3}

CO-4: Summarize the working of electrical and chassis systems with advanced features in an automotive. {L3}

CO-5: Discuss the combustion control strategies and exhaust gas treatment methods to control the emissions in an automotive engine. {L3}

Unit-1 **Teaching Hours:8**

Engine Components and Cooling & Lubrication Systems

Introduction: Automobile history and development, Chassis, frames, articulated and rigid vehicles, and vehicles layout, Prime movers. Spark Ignition {SI} & Compression Ignition {CI} engines, cylinder - arrangements and their relatives merits, Liners, Piston, connecting rod, crankshaft, valves, valve actuating mechanisms, valve and port timing diagrams, Types of combustion chambers for S.I. Engine and C.I. Engines, Compression ratio, methods of a Swirl generation, choice of materials for different engine components, engine positioning, cooling requirements, methods of cooling, thermostat valves, different lubrication arrangements.

Fuels, Fuel Supply Systems For SI and CI Engines: Conventional fuels, alternative fuels, normal and abnormal combustion, cetane and octane numbers, Fuel mixture requirements for SI engines, types of carburetors, C.D.& C.C. carburetors, multi-point and single point fuel injection systems, fuel transfer pumps, Fuel filters, fuel injection pumps, and injectors.

Unit-2 **Teaching Hours:8**

Superchargers and Turbochargers

Introduction: Naturally aspirated engines, Forced Induction, Types of superchargers, Turbocharger construction and operation, Intercooler, Turbocharger.

Power Trains: General arrangement of the clutch, Principle of friction clutches, Torque transmitted, Constructional details, Fluid flywheel, Single plate, multiplate and centrifugal clutches. Gear box: Necessity for gear ratios in transmission, synchromesh gear boxes, 3, 4 and 5 speed gear boxes. Free wheeling mechanism, planetary gears systems, over drives, fluid coupling and torque converters,

Epicyclic gear box, principle of automatic transmission, calculation of gear ratios, Numerical calculations for torque transmission by clutches.

Unit-3 **Teaching Hours:10**

Transmission System and Differential

Introduction: Propeller shaft, Universal joint, constant velocity joint, Hotchkiss drive, torque tube drive. Differential - Need and types, Rear Axles and Front Axles.

Brakes: Need, types Mechanical, hydraulic, Pneumatic Brakes, Electrical Brakes, Engine Exhaust brakes, Drum and Disc brakes, Comparison. Details of components, Brake adjustment, Brake by wire, Advantages over power Braking System.

Unit-4 **Teaching Hours:10**

Steering, Tyres and Suspension Systems

Introduction: Principle of steering, Center point steering, Steering linkages, Steering geometry and wheel alignment, Power Steering, Special steering systems. Electrical assist steering, Steering by wire, Advantages of Steering by wire. Tyres and suspension systems: Tyres, tyres specification, Factors affecting tyre performance, Special tyres, Wheel balancing, Suspension systems - Function of Spring and shock absorber, conventional and Independent suspension System, Telescopic shock absorber, Linked suspension systems. Semi-active and fully-active suspension system, Advantages of the fully active suspension system.

Electrical Systems: Construction, Operation and maintenance of Batteries, Advanced lead acid batteries, Alkaline batteries, Lithium batteries, Alternator working Principles and Operation of regulators, Starter motor, Battery ignition and Magneto Ignition Systems, Ignition Timing. Electronics Ignition, Lighting, Horn, Side indicator wiper.

Unit-5 **Teaching Hours:9**

Automotive Emission Control Systems

Introduction: Automotive emission controls, Controlling crankcase emissions, Controlling evaporative emissions, Cleaning the exhaust gas, Controlling the air-fuel mixture, Controlling the combustion process, Exhaust gas recirculation, Treating the exhaust gas, Air-injection system, Air-aspirator system, Catalytic converter, Emission standards- Euro I, II, III and IV norms, Bharat Stage II, III norms.

Advanced Features In Automobile: Recent advances such as ABS, Electronic Power Steering, Steer by wire, Traction control, Active suspension, Collision avoidance, Intelligent lighting, Navigational aids, and Intelligent vehicle highway system.

Text Books And Reference Books:

T1. Crouse, W.H., and Anglin, D.L“Automotive Mechanics”, Tata McGraw Hill, New Delhi, 2021.

T2. Heitner, J“Automotive Mechanics”, CBS Publisher, New Delhi, 2006.

T3. Automotive Mechanics, S. Srinivasan, Tata McGraw Hill 2017.

Essential Reading / Recommended Reading

R1. Narang, G.B., “Automobile Engineering”, Khanna Publishers, New Delhi, 2015.

R2.Kamaraju Ramakrishna “Automobile Engineering”, PHI Learning pvt. Ltd., New delhi, 2012

R3. Automotive mechanics: Principles and Practices, Joseph Heitner, D Van Nostrand Company, Inc.

R4. Automotive mechanics: Principles and Practices, Joseph Heitner, D Van Nostrand Company, Inc.

R5. Automobile Engineering, R. B. Gupta, Satya Prakashan, 4th Edition. 1984.

R6. Automobile engineering, Kirpal Singh. Vol I and II 2002.

Evaluation Pattern

ASSESSMENT PATTERN FOR THEORY COURSES					
	Component	Assessed for	Scaled down to	Min. marks to pass	Max. marks
1	CIA-1	20	**10**	-	**10**
2	CIA-2	50	**25**	-	**25**
3	CIA-3	20	**10**	-	**10**
4	Attendance	05	**05**	-	**05**
5	ESE	100	**50**	20	**50**
		TOTAL	**100**	-	**100**

ME742E1 - OPERATIONS MANAGEMENT (2020 Batch)

Total Teaching Hours for Semester:45 **No of Lecture Hours/Week:3**

Max Marks:100 **Credits:3**

Course Objectives/Course Description

- Describe what the operations function is and why it is critical to an organization's survival.
- Describe what a supply chain is and how it relates to a particular organization's operations function.
- Discuss what is meant by operations management and supply chain management.
- Identify some of the major operations and supply chain activities, as well as career opportunities in these areas.
- Make a case for studying both operations management and supply chain management.

Course Outcome

CO1: Express the applications of Operations management topics in decision-making. {L2}

CO2: Compute forecasting problems and capacity decisions using quantitative methods which include Time Series, and regression Analysis. {L2}

CO3: Planning of operational activity critical to the organization which will balance long-term strategic planning with short-term production success. {L2}

CO4: Compute the inventory level that should be maintained in an organization {L2}

CO5: Solve for the material requirement issues based on the demand statistics {L2}

Unit-1 **Teaching Hours:9**

Unit-1

Production and Operations Management: Introduction, Functions within business organizations, the operation management function, Classification of production systems, Productivity, factors affecting productivity, contemporary issues, and development.

Decision Making: The decision process, characteristics of operations decisions, use of models, decision-making environments, graphical linear programming, analysis, and trade-offs.

Unit-2 **Teaching Hours:9**

Unit-2

Forecasting: Steps in the forecasting process, approaches to forecasting, forecasts based on judgment and opinion, analysis of time series data, accuracy and control of forecasts, choosing a forecasting technique, and elements of a good forecast.

Capacity & Location Planning: Importance of capacity decisions, defining and measuring capacity, determinants of effective capacity, determining capacity requirement, developing capacity alternatives, evaluating alternatives, Need for location decisions, nature of locations decisions, the general procedure for making locations decisions, evaluating locations decisions, facilities layout – need for layout decisions, types of processing.

Unit-3 **Teaching Hours:9**

Unit-3

Aggregate Planning & Master Scheduling: Aggregate planning – Nature and scope of aggregate planning, strategies of aggregate planning, techniques for aggregate planning – graphical and charting techniques, mathematical techniques. The master production schedule, Master scheduling process, and Master scheduling methods.

Unit-4 **Teaching Hours:9**

Unit-4

Inventory Management: Types of Inventories, independent and dependent demand, reasons for holding inventory, objectives of inventory control, requirements for effective inventory management – information, cost, priority system. Inventory control and economic-order-quantity models.

Unit-5 **Teaching Hours:9**

Unit-5

Material Requirement Planning {MRP}: Dependent versus independent demand, an overview of MRP – MRP inputs and outputs, MRP processing, An overview of MRP-II and ERP capacity requirement planning, benefits and limitations of MRP.

Purchasing and Supply Chain Management {SCM}: Introduction, Importance of purchasing and SCM, The procurement process, Concept of tenders, Approaches to SCM, Vendor development, Measures of purchasing and SCM, Make or buy decision, Types of buying, E-procurement.

Text Books And Reference Books:

T1.William J Stevenson "Production and Operations Management",8th Edition, Tata McGraw Hill.

T2. B Mahadevan "Operations Management-Theory and Practice", Pearson Education, 2010.

Essential Reading / Recommended Reading

R1. Norman Gaither & Greg Frazier“Production and Operations Management”.

R2. R.B.Chase, N.J.Aquilino, F. Roberts Jacob“Operations Management for Competitive Advantage”,Ninth Edition,McGraw Hill Companies Inc.,. 2006

R3. Everett E.Adams, Ronald J.Ebert“Production & Operations Management”,Prentice Hall of India Publications, 4th Edition.

R4. Joseph G Monks,”Production / Operations Management”, McGraw Hill Books 1987.

Evaluation Pattern

ASSESSMENT PATTERN FOR THEORY COURSES					
	Component	**Assessed for**	**Scaled down to**	**Min. marks to pass**	**Max. marks**
1	CIA-1	20	**10**	-	**10**
2	CIA-2	50	**25**	-	**25**
3	CIA-3	20	**10**	-	**10**
4	Attendance	05	**05**	-	**05**
5	ESE	100	**50**	20	**50**
		TOTAL	**100**	-	**100**

ME742E8 - MACHINE LEARNING USING PYTHON PROGRAMMING (2020 Batch)

Total Teaching Hours for Semester:45 **No of Lecture Hours/Week:3**

Max Marks:100 **Credits:3**

Course Objectives/Course Description

This Machine Learning with Python course dives into the basics of machine learning using Python, an approachable and well-known programming language. You'll learn about supervised vs. unsupervised learning, look into how statistical modeling relates to machine learning, and do a comparison of each.

This course will explore many popular algorithms including Classification, Regression, Clustering, and Dimensional Reduction, and popular models such as Train/Test Split, Root Mean Squared Error (RMSE), and Random Forests.

Course Outcome

CO1: Develop an appreciation for what is involved in learning models from data. {L1}

CO2: Understand a wide variety of learning algorithms. {L2}

CO3: Understand how to evaluate models generated from data {L3}

CO4: Apply the algorithms to a real-world problem, optimize the models learned, and report on the expected accuracy that can be achieved by applying the models {L3}

CO5: Apply python programing for ML applications. {L3}

Unit-1 **Teaching Hours:8**

Introduction to Machine Learning

Applications of Machine Learning, Supervised vs Unsupervised Learning, Python libraries suitable for Machine Learning.

Unit-2 **Teaching Hours:10**

Regression

Linear Regression, Non-linear Regression, Model evaluation methods.

Unit-3 **Teaching Hours:10**

Classification

K-Nearest Neighbour, Decision Trees, Logistic Regression, Support Vector Machines, Model Evaluation.

Unit-4 **Teaching Hours:8**

Unsupervised Learning

K-Means Clustering, Hierarchical Clustering, and Density-Based Clustering.

Unit-5 **Teaching Hours:9**

Recommender Systems

Content-based recommender systems, Collaborative Filtering.

Text Books And Reference Books:

T1. Andreas Mueller, “Introduction to Machine Learning with Python: A Guide for Data Scientists”, Publisher: Shroff/O'Reilly; First edition (1 January 2016), ISBN-10: 9352134575.

T2: Pradhan Manaranjan, "Machine Learning Using Python", Publisher: Wiley india Pvt. Ltd, ISBN: 9788126579907, 9788126579907.

Essential Reading / Recommended Reading

R1. Abhishek Kumar Pandey, "A Practical Approach for Machine Learning and Deep Learning Algorithms: Tools and Techniques Using MATLAB and Python", Publisher : BPB Publications (1 January 2019), ISBN-10 : 9388511131, ISBN-13 : 978-9388511131.

R2. Avishek Nag, "Pragmatic Machine Learning with Python", Publisher: BPB Publications, ISBN: 9789389845365, January 2020.

R3. Harsh Bhasin, "Machine Learning for Beginners: Learn to Build Machine Learning Systems Using Python", Publisher: BPB Publications (1 January 2020), ISBN-10 : 9389845424, ISBN-13: 978-9389845426.

Evaluation Pattern

ASSESSMENT PATTERN FOR THEORY COURSES					
	Component	**Assessed for**	**Scaled down to**	**Min. marks to pass**	**Max. marks**
1	CIA-1	20	**10**	-	**10**
2	CIA-2	50	**25**	-	**25**
3	CIA-3	20	**10**	-	**10**
4	Attendance	05	**05**	-	**05**
5	ESE	100	**50**	20	**50**
		TOTAL	**100**	-	**100**

ME744E4 - RAPID PROTOTYPING (2020 Batch)

Total Teaching Hours for Semester:45 **No of Lecture Hours/Week:3**

Max Marks:100 **Credits:3**

Course Objectives/Course Description

This course provides the fundamental knowledge of Rapid Prototyping and Automated fabrication, including the generation of suitable CAD models, current Rapid Prototyping fabrication technologies, their underlying material science, the use of secondary processing, and the impact of these technologies on society. The rapid prototyping process will be illustrated by the actual design and fabrication of a part.

Course Outcome

CO1: Classify the stages of development related to the RP system and based on material types. {L2}

CO2: Compare different RP processes based on process parameters to create a product. {L2}

CO3: Categorize the different Rapid Tooling processes for batch production. {L3}

CO4: Select and use correct data formats in the manufacture of a 3D printed part. {L3}

CO5: Prioritize suitable orientation workflow for better part fabrication process & reduced part build errors. {L3}

Unit-1 **Teaching Hours:9**

Introduction and Stereo Lithography Systems

Introduction: Need for compression in product development, history of RP systems, Survey of applications, Growth of RP industry, and classification of RP systems.

Stereo Lithography Systems: Principle, Process parameter, Process details, Data preparation, data files and machine details, Application.

Unit-2 **Teaching Hours:9**

Selective Laser Sintering and Solid Ground Curing

Selective Laser Sintering: Type of machine, Principle of operation, process parameters, Data preparation for SLS, Application, Fusion Deposition Modelling Principle, Process parameter, Path generation, Applications.

Solid Ground Curing: Principle of operation, Machine details, Applications. Laminated Object Manufacturing: Principle of operation, LOM materials. Process details, application.

Unit-3 **Teaching Hours:9**

Concepts Modelers and Rapid Tooling

Concepts Modelers: Principle, Thermal jet printer, Sander's model market,3-D printer. GenisysXs printer HP system 5, object Quadra systems.

Rapid Tooling: Indirect Rapid tooling, Silicon rubber tooling, Aluminium filled epoxy tooling, Spray metal tooling, Cast kirksite, 3Q keltool, etc. Direct Rapid Tooling Direct. AIM.

Unit-4 **Teaching Hours:9**

Rapid Tooling

Rapid Tooling: Indirect Rapid tooling, Silicon rubber tooling, Aluminium filled epoxy tooling, Spray metal tooling, Cast kirksite, 3Q keltool, etc. Direct Rapid Tooling Direct. AIM.

Rapid Tooling: Quick cast process, Copper polyamide, Rapid Tool, DMILS, Prometal, Sand casting tooling, Laminate tooling soft Tooling vs. hard tooling.

Unit-5 **Teaching Hours:9**

Software for RP and Rapid Manufacturing Process Optimization

Software for RP: STL files, Overview of Solid view, magics, imics, magic communicator, etc. Internet based software, Collaboration tools.

Rapid Manufacturing Process Optimization: Factors influencing accuracy. Data preparation errors, Part building errors, Error in finishing, and the influence of build orientation.

Text Books And Reference Books:

T1. Paul F. Jacob “Stereo Lithography and other RP & M Technologies”, SME, NY 1996.

T2. FlhamD.T&Dinjoy S.S Verlog “Rapid Manufacturing”, London 2001.

Essential Reading / Recommended Reading

R1. Rapid Prototyping, Terry Wohler’s Report 2000 "Wohler's Association 2000.

R2. Gurumurthi“ Rapid Prototyping Materials”, IISc Bangalore.

R3. Lament wood “Rapid Automated”, Indus press New York.

Evaluation Pattern

ASSESSMENT PATTERN FOR THEORY COURSES					
	Component	**Assessed for**	**Scaled down to**	**Min. marks to pass**	**Max. marks**
1	CIA-1	20	**10**	-	**10**
2	CIA-2	50	**25**	-	**25**
3	CIA-3	20	**10**	-	**10**
4	Attendance	05	**05**	-	**05**
5	ESE	100	**50**	20	**50**
		TOTAL	**100**	-	**100**

ME744E7 - LEAN MANUFACTURING (2020 Batch)

Total Teaching Hours for Semester:45 **No of Lecture Hours/Week:3**

Max Marks:100 **Credits:3**

Course Objectives/Course Description

1. This course will introduce graduate and advanced undergraduate students and practicing engineers to lean production principles and practice.
2. Facilitate students to continuously improve operational performance and systems that are fast, flexible, focused for fulfilling the career advancements.
3. The course will provide the student with an in-depth knowledge of lean production.
4. This course shall help students describe the background behind its development.
5. The major objective of this course is to help students inculcate evaluations and assessments of production systems.

Course Outcome

CO1: Explain the principles of lean manufacturing. {L2}

CO2: Identify the potential applications of lean manufacturing in various industries. {L3}

CO3: Apply the tools/techniques of lean manufacturing to preventive maintenance and production. {L4}

CO4: Apply the tools/techniques of lean manufacturing in value-added standardization work. {L4}

CO5: Apply the tools/techniques of lean manufacturing to inventory and quality control. {L4}

Unit-1 **Teaching Hours:9**

Lean Manufacturing

History of Lean Manufacturing, Objectives of Lean Manufacturing, Key Principles of Lean Manufacturing, Key Implications of Lean Manufacturing.

Unit-2 **Teaching Hours:9**

Lean Manufacturing Concepts

Value Creation and Waste, Main Kinds of Waste, Customer pull vs push, Pull Production Different models of Pull Production, Impact of Pull Production on Production Planning, one piece flow Takt time and calculation, Continuous Flow, Mixing Continuous and Discontinuous Flow, Continuous Improvement, Kaizen, People Involvement, Cellular Layout, Administrative Lean.

Unit-3 **Teaching Hours:9**

Lean Manufacturing Tools

Standard Work, Communication of Standard Work to employee's, Standard work and flexibility, TPS and lean house, Visual Management, Quality at the Source, Value Stream Mapping, The Five S's, Preventative Maintenance, Total Productive Maintenance, Changeover/ setup time, Batch size reduction, Production layout and point of use storage, Kanban, Production Leveling, Pacemaker, Overall Equipment Effectiveness.

Unit-4 **Teaching Hours:9**

Lean Manufacturing Implementation

Value Stream Mapping: Defining value, Creating VSM current state and calculation of VA and NVA, Set up future state, understand gaps, identify process weakness and bottlenecks, developing action plan., Lean layout to reduce inventory, space, transportation and motion, improve information flow, Standardization work and simulation, Standard work combination table, TPM to reduce machine breakdown time, SMED to reduce changeover time, On site quality management and control of scrap and rework, 5S and visual management, Kanban and pull Judoka, Pursue perfection and kaizen.

Unit-5 **Teaching Hours:9**

Inventory and Quality Control Under Lean Manufacturing

Principles of inventory control, Comparison of JIT/lean and large lot EOQ operations, JIT purchasing, and supplier relations, new technologies support Lean manufacturing, JIT/EOQ Models, Methodology for vendor evaluation, Performance measurement of JIT inventory control, Implementing a strategy for JIT purchasing, Principles of JIT quality control, Process control charts, Quality control circles, Performance measurement of JIT quality control.

Text Books And Reference Books:

1. The Toyota Way Field book, Jeffrey Liker, and David Meier
2. Pascal Dennis "Lean Production Simplified", McGraw-Hill, 2006.

Essential Reading / Recommended Reading

1. Askin R G and Goldberg J B, "Design and Analysis of Lean Production Systems", John Wiley and Sons Inc., 2003.
2. Michael L George, David T Rowlands, and Bill Kastle, "What is Lean Six Sigma", McGraw Hill, New York, 2004.
3. Micheal Wader, "Lean Tools: A Pocket Guide to Implementing Lean Practices", Productivity and Quality Publishing Pvt.Ltd., 2002.
4. Kenichi Sekine, "One-Piece Flow", Productivity Press, Portland, Oregon, 1992.
5. Alan Robinson, "Continuous Improvement in Operations", Productivity Press, Portland, Oregon, 1991.

Evaluation Pattern

ASSESSMENT PATTERN FOR THEORY COURSES					
	Component	Assessed for	Scaled down to	Min. marks to pass	Max. marks
1	CIA-1	20	**10**	-	**10**
2	CIA-2	50	**25**	-	**25**
3	CIA-3	20	**10**	-	**10**
4	Attendance	05	**05**	-	**05**
5	ESE	100	**50**	20	**50**
		TOTAL	**100**	-	**100**

ME751 - SIMULATION LABORATORY (2020 Batch)

Total Teaching Hours for Semester:30 **No of Lecture Hours/Week:2**

Max Marks:50 **Credits:1**

Course Objectives/Course Description

- MATLAB environment and commands.
- Linear Algebra and matrices, fundamental engineering computing.
- Save, load, display and print commands.
- Communication with Excel & 2D and 3D plotting.
- Solutions to systems of linear equations.
- Conditional statements & amp; Loops.
- MATLAB scripts and functions.
- Polynomials, including differentiation and integration.

- Using MATLAB for simple engineering problems.

Course Outcome

CO1: Mathematical modeling for Plotting. (L3)

CO2: Mathematical modeling for solving the problem of Engineering Mechanics. (L5).

CO3: Develop feasible solutions for given structured models. (L4)

Unit-1 **Teaching Hours:30**

List of Experiments

1. Introduction to MATLAB: Graphical User Interface (GUI) of MATLAB, Use MATLAB as a sophisticated calculator, Syntax and semantics.
2. Plotting in MATLAB: Technique to draw the graph of functions in a variety of formats by using MATLAB. Plotting in the plane, plotting the graphs of function, graphs defined by parametric and polar equations. 3-space and investigate the nature of curves and surfaces in space.
3. Matrices and Operations: Define matrices and vectors, extract parts of them and combine them to form new matrices. How to use operators to add, subtract, multiply and divide matrices.
4. Functions: Breaking the complex problem into smaller, more manageable parts. We will learn how functions let us create reusable software components that can be applied in many different programs. We will learn how the environment inside a function is separated from outside via a well-defined interface through which it communicates with outside world. We will learn how to define a function to allow input to it when it initiates its execution and output from it when it is done.
5. Loops: MATLAB's loop construct: The for-loop, if-loop and the while-loop and nested loops.
6. Engineering Mechanics problems: Initially we will discuss about theoretical background of topic. Further, we will learn how to use MATLAB programming for solving engineering mechanics problems.

Text Books And Reference Books:

Text Books:

1. M. Asghar Bhatti, "FUNDAMENTAL Finite Element Analysis and Applications with Mathematica and MATLAB Computations", Wiley India Pvt. Ltd.

2.Stormy Attaway, "Matlab: A Practical Introduction to Programming and Problem Solving", 3rd edition, Butterworth-Heinemann Publisher.

3.W. Y. Yang and W. C. T.-S. Chung., Applied Numerical Methods Using Matlab, John Wiley & Sons, Inc., 2005.

Essential Reading / Recommended Reading

Reference Books:

R1. S. J. Chapman, MATLAB programming for engineers, New Delhi: Cengage Learning, 2004.

R2. K. B. Datta, Matrix and Linear Algebra Aided with Matlab, New Delhi: PHI Learning Private Limited, 2009.

R3. M. P. Coleman, An introduction to partial differential equations with MATLAB, Boca Raton: CRC Press, 2005.

Online Resources:

W1.https://nptel.ac.in/

Evaluation Pattern

ASSESSMENT PATTERN FOR PRACTICAL COURSES			
ONLY PRACTICAL			
	Component	Assessed for	Scaled down to
1	CIA	50	25
2	ESE	50	25
		TOTAL	50

ME781 - PROJECT WORK PHASE I (2020 Batch)

Total Teaching Hours for Semester:60 **No of Lecture Hours/Week:4**

Max Marks:100 **Credits:2**

Course Objectives/Course Description

Project work Phase-I includes identifying the problem, literature review and necessary ground work so as to continue it as Phase-II during VIII semester.

Presentations on these are to be given as per the schedule announced by the department.

Course Outcome

CO1: Enabling the student to identify the problems in the existing systems of their proposed area and define the objectives of their proposed work. [L2]

CO 2: Develop a skill for handling multiple situations, practical problems, analyzing teamwork and communication abilities. [L2]

CO 3: Compile theory with practice and carry out performance objectives on strong work ethics, persistence, adaptability, and critical thinking. [L3]

CO4: Analyze the work environment and create solutions to problems. [L4]

CO5: Build a record of work experience and construct a good relationship with the teammates. [L5]

Unit-1 **Teaching Hours:60**

Project

Continuous Internal Assessment:50 Marks

- Presentation assessed by Panel Members
- Assessment by the Guide
- Project Progress Reports

Text Books And Reference Books:

Journals

Essential Reading / Recommended Reading

Journals

Evaluation Pattern

Project progress report 25 Marks

Presentation 25 Marks

ME782 - INTERNSHIP (2020 Batch)

Total Teaching Hours for Semester:60 **No of Lecture Hours/Week:4**

Max Marks:50 **Credits:2**

Course Objectives/Course Description

Internships are short-term work experiences that will allow a student to observe and participate in professional work environments and explore how his interests relate to possible careers. They are important learning opportunities through industry exposure and practices. More specifically, doing internships is beneficial because they provide the opportunity to:

- Get an inside view of an industry and organization/company
- Gain valuable skills and knowledge
- Make professional connections and enhance student's network
- Get experience in a field to allow the student to make a career transition

Course Outcome

CO1: To experience 60 days of internship training, enabling the student for onsite visits, study projects, and practical training. {L4}

CO2: To develop a skill for handling multiple situations, practical problems, analyzing teamwork, and communication abilities. {L2}

CO3: To integrate theory with practice and carry out performance objectives on strong work ethics, persistence, adaptability, and critical thinking. {L3}

Unit-1 **Teaching Hours:60**

INTERNSHIP

1. The student shall undergo an Internship for 60 days starting from the end of 2nd semester examination and completing it during the initial period of 7th semester.
2. The department shall nominate a faculty as a mentor for a group of students to prepare and monitor the progress of the students
3. The students shall report the progress of the internship to the mentor/guide at regular intervals and may seek his/her advise.
4. The Internship shall be completed by the end of 7th semester.
5. The students are permitted to carry out the internship outside India with the following conditions, the entire expenses are to be borne by the student and the University will not give any financial

assistance.
6. Students can also undergo internships arranged by the department during vacation.
7. After completion of Internship, students shall submit a report to the department with the approval of both internal and external guides/mentors.
8. There will be an assessment for the internship for 2 credits, in the form of report assessment by the guide/mentor and a presentation on the internship given to department constituted panel.
9. Mandatory one MOOC course completed certificate is required at the time of submission of report.

Text Books And Reference Books:

T1.Pamela Myers Kiser, "Human Services Internship: Getting the Most From Your Experience", Cengage Learning, 4th Edition, 2016. (ISBN13: 978-1305087347)

T2.H. Frederick Sweitzer, "Successful Internship", Brooks/Cole Publishing Co., 5th Edition, 2019.

Essential Reading / Recommended Reading

R1.Bill Hobbs, Zach Schleien, "Hacking the Internship Process (Work)", La Plata Press, Paperback, 2017.

Evaluation Pattern

Continuous Internal Assessment (CIA) is based upon

- No of Internship Days : 20 marks
- Type of Industry and Work Carried out : 10 marks
- Report on Internship : 10 marks
- Presentation on Internship : 10 marks

NCCOE2 - NCC2 (2020 Batch)

Total Teaching Hours for Semester:45 **No of Lecture Hours/Week:3**

Max Marks:100 **Credits:3**

Course Objectives/Course Description

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Course Outcome

CO1: Demonstrate Foot drill, Rifle Drill and ceremonial Drill(L3)

CO2: Illustrate the importance and need for National integration(L2)

CO3: Make use of Leadership traits to organize critical decisions (L3)

CO4: Relate to Social Issues and contribute to the Environmental sustainability (L2)

C05: Utilize Community Development skills for social wellbeing(L3)

Unit-1 **Teaching Hours:9**

Drill

Foot Drill – Marching Salute- Flight formation- Slow march- Rifle Drill- Guard of honor- Present Arm.

Unit-2 **Teaching Hours:9**

National Integration

Importance & Necessity-Factors Affecting National Integration- Unity in Diversity & Role of NCC in Nation Building- Threats to National Security.

Unit-3 **Teaching Hours:9**

Leadership

Leadership Defined - Ways of Conceptualizing Leadership -Definition and Components- Leadership Described -Trait Versus Process Leadership - Assigned Versus Emergent Leadership -Leadership and Power - Leadership and Coercion- Leadership and Management- The Trait Description

Case Studies: Shivaji, Jhasi Ki Rani

Unit-4 **Teaching Hours:9**

Social Issues and the Environment

Resettlement and rehabilitation of people - environmental ethics: issues and possible solutions - nuclear accidents and nuclear holocaust -wasteland reclamation consumerism and waste products.

Environment protection act air (prevention and control of pollution) act 194- water (prevention and control of pollution) ACT 196

Unit-5 **Teaching Hours:9**

Community Development

Contribution of Youth- Social Evils- Protection of Children & Women Safety- Cyber and Mobile Security Awareness - Hygiene and Sanitation (Personal and Camp).

Text Books And Reference Books:

Airwing Cadet Handbook, Common Subject SD/SW, Maxwell Press, 2015.

Essential Reading / Recommended Reading

Textbook of Environmental Studies for Undergraduate Courses, Erach Barucha, Orient Black swan Pvt Ltd, 2nd edition, march 2021

Evaluation Pattern

1. The assessment will be carried out as overall internal assessment at the end of the semester for 100 marks based on the following.

- Each cadet will appear for 'C' Certificate exam which is centrally conducted by the Ministry of Defense, NCC directorate. The Total marks will be for 350.
- Each cadets score will be normalized to a maximum of 100 marks based on the overall marks Secured by each cadet.

ME841E5 - GREEN BELT PRACTICE (2020 Batch)

Total Teaching Hours for Semester:45 **No of Lecture Hours/Week:3**

Max Marks:100 **Credits:3**

Course Objectives/Course Description

- To Lead a Team, using the DMAIC process to solve a problem.
- Use Statistical tools to analyse data and prove or disprove a hypothesis.
- Understand the difference between tools, to select and use the appropriate one{s}.
- Apply Lean to solve problems encountered in business settings.
- Train White and Yellow Belts to strengthen your own knowledge of these tools and concepts.
- Provide project updates and presentation of results to management with associated savings.

Course Outcome

CO1: Understand the concepts of quality control, improvement, and management. {L2}

CO2: Understand and apply different tools & techniques of quality engineering and management. {L3}

CO3: Understand the concept of design for quality. {L2}

CO4: Understand and apply the concept and importance of service quality. {L2}

CO5: Understand quality management standards. {L2}

Unit-1 **Teaching Hours:9**

Introduction

Different Definitions and Dimensions of Quality, Historical Perspective {From Evolution of Quality Control, Assurance and Management to Quality as Business Winning Strategy}, Contribution of Renowned QualityGurus {Their Philosophies and Impact on Quality}.

Unit-2 **Teaching Hours:9**

Quality Engineering and Management Tools, Techniques & Standards {A}

Statistical Quality Control: Causes of Variation, Control Chartsfor Variables {Mean and Range, Mean and Standard Deviation, Cumulative Sum Control Chart}, Control Chart Patterns and Corrective Actions, Control Charts for Attributes {p-chart, npchart,c-chart, u-chart}, Acceptance Sampling Plans {Concepts of Producer's and Consumer's Risks, Types of Sampling Plans andtheir merits and demerits, Operating Characteristic Curve, Average Outgoing Quality Curve}, Errors in Making Inferences from Control Charts {Type I and II errors}.

Unit-3 **Teaching Hours:9**

Quality Engineering and Management Tools, Techniques & Standards {B}

Quality Control & Improvement Tools: 7 QC tools, 7 New Quality Management Tools, 5S Technique, Kaizen, Poka-Yoke Quality Circle, Cost of Quality Technique. Quality Engineering and Management Tools, Techniques & Standards: {C} Quality Assurance and Management: ISO:9000, ISO:14000, QS:9000 {Concept, Scope, Implementation Requirements &Barriers, and Benefits}.

Unit-4 **Teaching Hours:9**

Designing for Quality

Introduction to Concurrent Engineering, Quality Function Deployment {QFD} and Failure Mode and Effect Analysis {FMEA} – Concept, Methodology and Application.

Quality in Service Sectors: Characteristics of Service Sectors, Quality Dimensions in Service Sectors, Measuring Quality in Different Service Sectors.

Unit-5 **Teaching Hours:9**

SIX Sigma Fundamentals

Basic Concept, Methodology, Process Improvement Model {DMAIC} Steps {Objectives, Tools and Techniques Used}, Six Sigma Organization, Six Sigma Implementation Requirements, Introduction to Lean Six Sigma.

Text Books And Reference Books:

T1. Amitava Mitra "Fundamentals of Quality Control and Improvement", Prentice – Hall International Edition.

T2. Frank M. Gryna, Richard C. H. "Juran's Quality Planning & Analysis for Enterprise Quality",Tata McGraw Hill Edition.

T3. Dale H. Besterfield, Carol Besterfield-Michna, Glen H. Besterfield and Mary Besterfield-Sacre "Total Quality Management", Pearson Educaiton.

T4. Craig W. Baird "The Six Sigma Manual for Small and Medium Businesses", Yes Dee Publishing Pvt. Ltd.

T5. N. Logothetis "Managing for Total Quality", Prentice Hall of India Pvt. Ltd.

Essential Reading / Recommended Reading

R1. Eugene L. Grant and Richard S. Leavenworth "Statistical Quality Control", Tata McGrawHill Publishing Company Ltd.

R2. B. L. Hanson & P. M. Ghare "Quality Control & Application", Prentice Hall of India.

R3. J. M. Juran & F. M. Gryna "Quality Control Handbook", Prentice Hall Publications.

R4. K C Arora "Total Quality Management", S K Kataria & Sons.

R5. Dr. S. Kumar "Total Quality Management", Laxmi Publication Pvt. Ltd.

R6. Warren Brussee "All About Six Sigma", Tata McGraw Hill Edition.

Online Resources:

W1. https://onlinecourses.nptel.ac.in/noc17_mg08/preview

Evaluation Pattern

ASSESSMENT PATTERN FOR THEORY COURSE			
	Component	Assessed for	Scaled Down to
1	CIA I	20	10
2	CIA II	50	25
3	CIA III	20	10
4	Attendance	5	5
5	ESE	100	50
		Total	100

ME841E7 - AGILE MANUFACTURING (2020 Batch)

Total Teaching Hours for Semester:45 **No of Lecture Hours/Week:3**

Max Marks:100 **Credits:3**

Course Objectives/Course Description

1. To facilitate the students to appreciate the importance of the concepts of agile manufacturing.
2. To allow innovativeness to develop in students.
3. To understand the significance of new product development in manufacturing.
4. To facilitate students to apply the knowledge of agile manufacturing in integrated product development.
5. To allow students inculcate skill and knowledge in agile manufacturing.

Course Outcome

CO1: Get an overview of Agile Manufacturing, its need, and strategies. (L3)

CO2: Know the process of developing an agile manufacturing/enterprise. (L4)

CO3: Integrating Product/Process development. (L4)

CO4: To apply the concept of agile in multimedia, Information Technology/Science (IT/IS), supply chain management and enterprise integration. (L5)

CO5: Learn the computer control of agile manufacturing. (L5)

Unit-1 **Teaching Hours:9**

Agile Manufacturing

Definition, business need, conceptual frame work, characteristics, generic features. Four Core concepts: Strategy driven approach-integrating organization, people technology, and interdisciplinary design methodology.

Unit-2 **Teaching Hours:9**

Integration of Product /Process Development

Principles, Robust design approach. Approaches to enhance ability in manufacturing, Role of QFD, Managing people in agile organization, Approaches.

Unit-2 **Teaching Hours:9**

Developing Agile Manufacturing

Enterprise design, System concepts as the basic manufacturing theory-joint technical & Organizational design and a model for the design of agile manufacturing enterprise. Enterprise design process insights into design processes, what is interdisciplinary design, main issues, and simple design example.

Unit-3 **Teaching Hours:9**

Agile Supply Chain Management

Principles, IT/IS concepts in supply chain management, enterprise integration and management in agile manufacturing, concepts, Agility, Adaptability and learners – comparison of concepts.

Unit-3 **Teaching Hours:9**

Application of It/Is Concepts In Agile Manufacturing

Strategies, Management of complexities and information. Flow, approaches, applications of multimedia to improve agility in manufacturing, system concepts.

Unit-4 **Teaching Hours:9**

Corporate Knowledge Management In Agile Manufacturing

Strategies, strategic options in agile manufacturing, Role of standards.

Unit-4 **Teaching Hours:9**

Computer Control of Agile Manufacturing

CAPP for Agile Manufacturing, Aggregate capacity planning and production line design / redesign in Agile manufacturing, Cellular manufacturing, concepts, examples.

Unit-5 **Teaching Hours:9**

Design of Skill & Knowledge

Enhancing technology for Machine tool system, Resumption of design requirement geometry, definition, methods, decision support for selection of cutting parameters, design enhancements, parametric approach only.

Text Books And Reference Books:

T1. Poul T Kidd, Amagow Co “Agile Manufacturing- Forging Mew Frontiers”. UK, ISBN0-201-63163-6, 1994.

T2. A Gunasekharan ‘‘Agile Manufacturing”, the 21stCenturyCompetitive strategy, ISBN -13978-0-08-04 3567-1, Elsevier Press, India.

Essential Reading / Recommended Reading

R1. Joseph C Moutigomery and Lawrence O Levine “Transitions to Agile Manufacturing”.

R2. Milwaukee. Wisconsin “Staying Flexible for competitive advantage”, ASQC quality press, USA, 1996.

R3. David M Anderson and B Joseph Pine “Agile Development for Mass Customization”, Irwin Professional Publishing, Chicago, USA, 1997.

Online Resources:

W1. https://nptel.ac.in/courses/110101010/modules/module2/lec3/1.3.html

W2. https://nptel.ac.in/courses/112104188/

W3. https://nptel.ac.in/courses/112107077/

Evaluation Pattern

ASSESSMENT PATTERN FOR THEORY COURSE			
	Component	Assessed for	Scaled Down to
1	CIA I	20	10
2	CIA II	50	25
3	CIA III	20	10
4	Attendance	5	5
5	ESE	100	50
		Total	100

ME881 - PROJECT WORK PHASE II (2020 Batch)

Total Teaching Hours for Semester:300 **No of Lecture Hours/Week:20**

Max Marks:300 **Credits:10**

Course Objectives/Course Description

Students in a group of maximum four work on a project. The nature of project may be a design and fabrication, modelling and analysis, a case study, etc. The project may also be taken at an industry ot research organisation with the permission from the department. The faculty member will be assigned as an internal guide who will monitor assess the progress regularly. A report on the project work in the approved format is to submitted on or before the dates announced by the department. Examination requires demonstration of the project in the presence of an external examiner.

Course Outcome

CO1: Enabling the student to identify the problems in the existing systems of their proposed area and define the objectives of their proposed work. [L2]

CO2: Develop a skill for handling multiple situations, practical problems, analyzing team work and communication abilities. [L4]

CO3: Compile theory with practice and carry out performance objectives on strong work ethics, persistence, adaptability, and critical thinking. [L5]

CO4: Analyze the work environment and create solutions to problems. [L4]

CO5: Build a record of work experience and construct a good relationship with the teammates. [L4]

Unit-1 **Teaching Hours:300**

Projects Based on Specilaistions

Specializations include:

Design

Thermal

Manufacturing

Materials

Management Etc...

- Project work may be assigned to a Group of students (with due approval from the department)
- Each project will be supervised by a faculty member based on their expertise and assessed via written reports and presentation skills.
- If the respective guide is not available for the project, then the project coordinator will intervene to get an appropriate guide for a suitable project.
- Students should submit the weekly progress report signed duly by their Project Guide throughout the project.
- Training on software -Latex will be given to students to help them for writing the final report.
- The students are required to prepare a synopsis of their chosen area of interest based on the problem identification.
- The project guide will review the synopsis and give valuable suggestions for improvement of the synopsis.
- After finalizing the project synopsis, upon Zeroth's review of the project review committee, the project work and title will be finalized.

- The project review committee will be having a review on the update on the project work in a presence of a review panel of Members and faculty members every month.
- The final project review will close the project work with respect to the problem definition and objectives achieved in return.
- The draft report will be submitted for correction to the project guide followed by submission of the final report for Project Guide, HOD, and Dean Approval and signature.
- At the end of the project external viva-voce is conducted for all the projects and Novel projects are encouraged for publication in the Journal.
- Innovative projects are proposed to showcase in different engineering exhibitions and if possible students are encouraged to file a patent on those ideas.

Text Books And Reference Books:

The theme of the Project related journal papers and reference books.

Essential Reading / Recommended Reading

The theme of the Project related journal papers and reference books.

Evaluation Pattern

CIA -200M

Review - 1 : 50 marks

Review - 2 : 60 marks

Review - 3 : 90 marks

ESE-100M

Initial Write Up : 15 marks

Viva Voce: 25 marks

Demonstration: 35 marks

Project Report: 25 marks